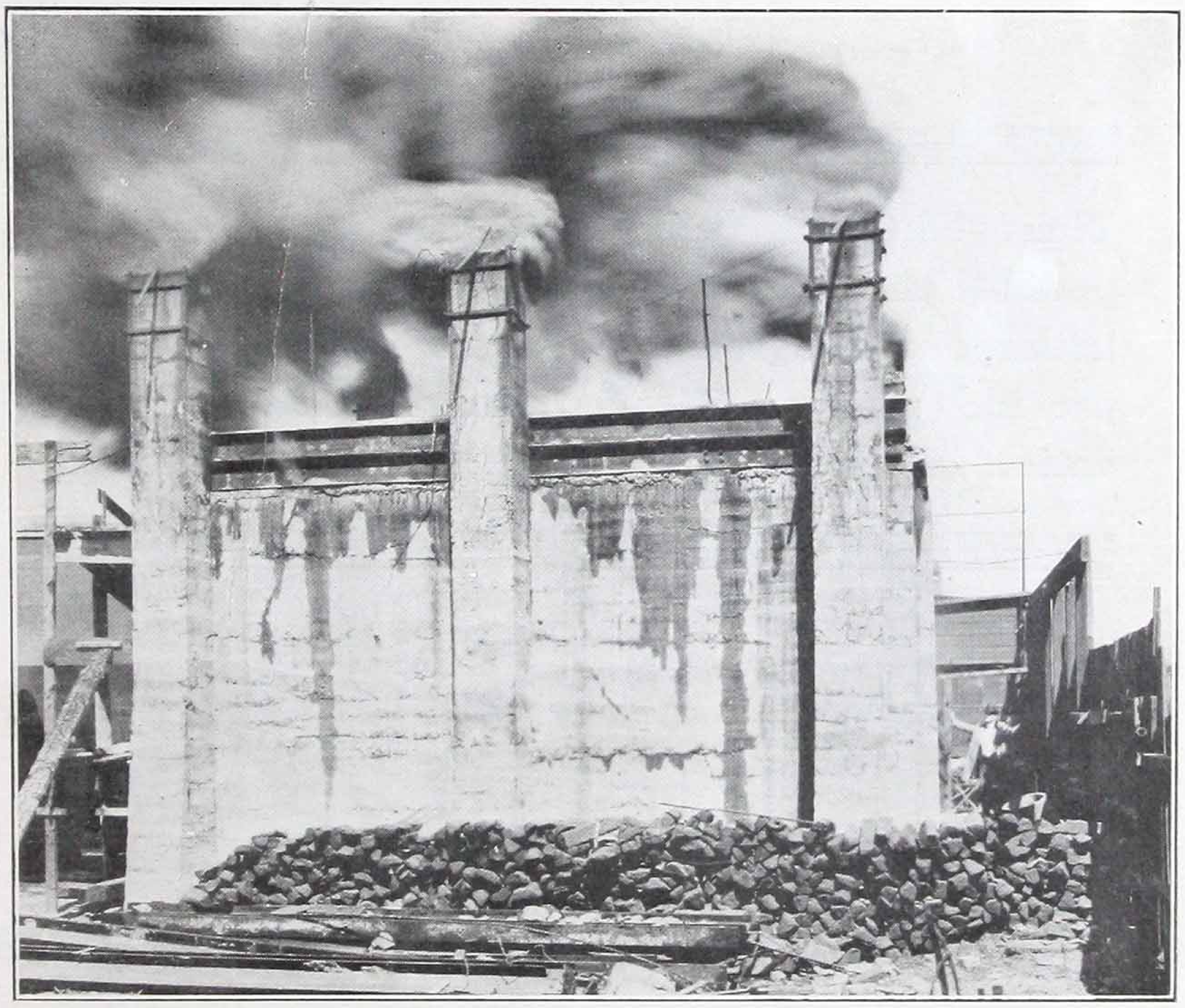
The Tests



fireproof construction

The Berger Manufacturing Co.
Canton, Ohio

Fire, Water and Load Tests on Berger's *Metal Lumber* System

(Patented)

OF

Pressed Steel Fireproof Construction

These Tests are designed to produce as near as possible the maximum conditions which prevail in large conflagrations and at the same time provide means of accurately recording the action of the material at all times.

The Berger Manufacturing Company

Canton, Ohio

Branches:

Boston New York Philadelphia Chicago
St. Louis Minneapolis San Francisco
Export Department: Berger Building, New York, U. S. A.

Test No. 1. (Unofficial)

Conducted by The Canton Laboratories, T. J. Hay, Director, Dec. 19th, 1911

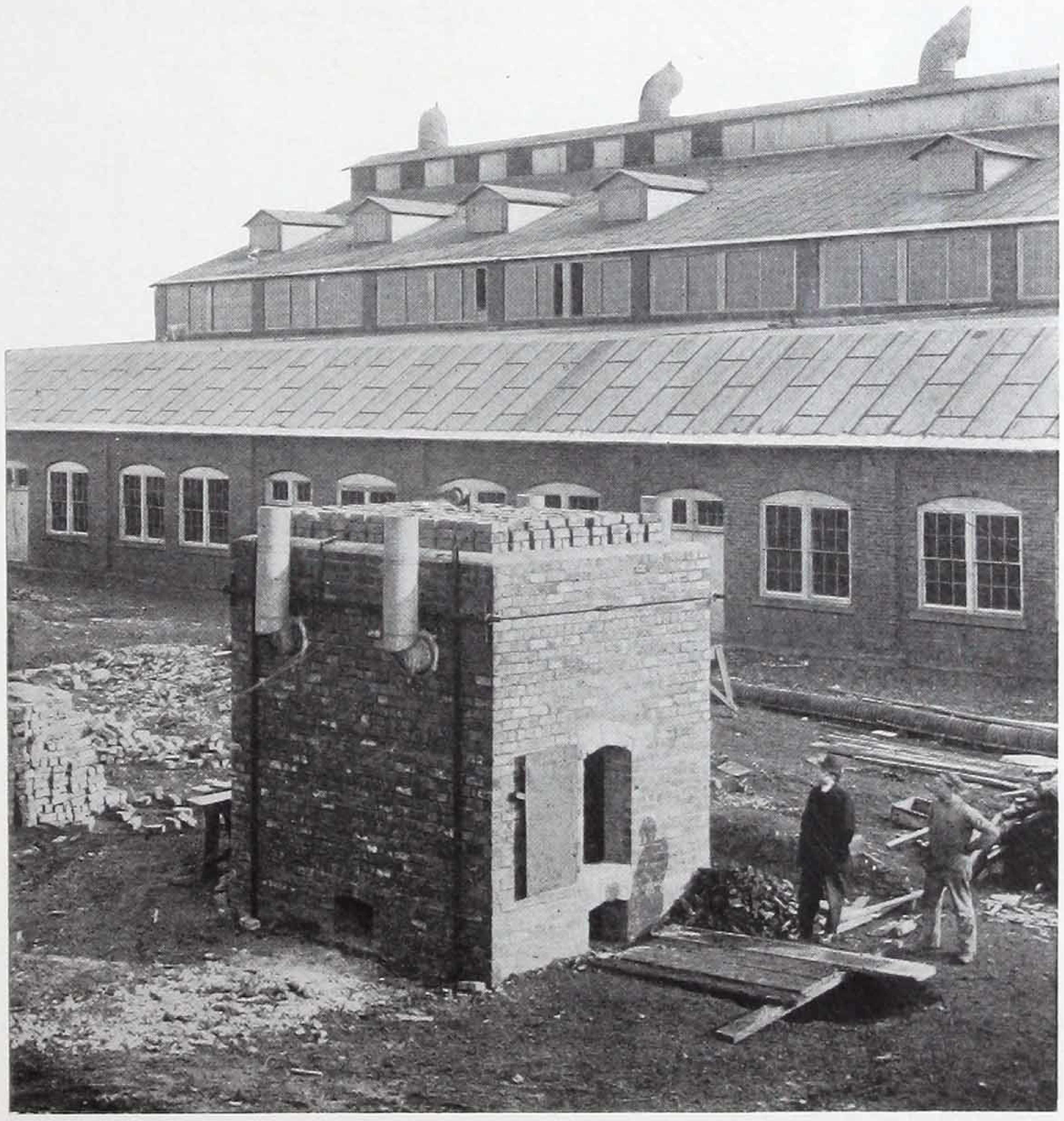
Purpose of Test

The purpose of this test was to determine the efficiency of a standard METAL LUMBER floor construction under a combination fire, load and water test, as might be applied under the most severe conditions to which the material could be subjected in practical use.

Method of Construction

The construction tested was the same as illustrated in Figure 2, Section AA—Page 9.

The furnace in which this test was made is shown in detail on pages 8, 9, 10, 11. It consisted of a building measuring 10 feet x 12 feet, outside dimensions, and provided with a grate consisting of "T" rails spaced $2\frac{1}{2}$ inches center to center. The distance from grate to ceiling was 9 feet 6 inches. The top of roof was of Metal Joist standard floor construction. Four flues with dampers were provided, two at each side of the building. Below the grate in the exterior walls were provided four draft doors 21 inches square, these doors being located one at each side and one at each end.



Fire, Load and Water Test on METAL LUMBER System of Fireproof Floor Construction Before Fire was Started. Normal Temperature 32° F.

The exterior walls consisted of 13 inches of brick, the inside layer of which was of fire-brick. The roof or floor slab (as it may be called) consisted of 6-inch joists, spaced 16 inches center to center and spanning the 10-foot dimension of the building, giving 8 feet clear span. The joists were diagonally bridged with

1-inch No. 20 gauge galvanized bridging, nailed directly into the webs. A layer of No. 24 gauge Plain Expanded Metal Lath was nailed directly to the top of joists and the lath covered with a concrete slab 2 inches in thickness. This slab was composed of one part cement, two parts sand, and four parts bank gravel.

To the bottom flanges of joists was applied by means of prongs punched thereon, No. 24 gauge Plain Expanded Metal Lath and lath was covered with two coats of cement plaster consisting of the following parts:

One part Diamond Portland Cement,
Two parts clean, sharp bank sand,
One-half part hydrated lime,
One-sixth part fiber plaster.

The first coat measured approximately 5/16 of an inch in thickness and was allowed to set twenty-four hours before the second coat was applied. The second coat was the same mixture as the first coat and approximately 7/16 of an inch in thickness.

A small coke fire was started in the building immediately after the second coat of plaster was applied, and with this fire an approximate temperature of 100 degrees was maintained for thirty-six hours. Six days after the plaster was applied the roof of building was uniformly loaded with Metropolitan paving blocks 75 pounds per square foot. While the furnace was under course of construction a thermo-couple was built in the center of the west wall, 4 inches from the ceiling.

An extensometer with 4 to 1 lever arm, supported by a special truss device, was applied to the top of roof and set accurately before fire was started.

Fire, Load and Water Test on METAL LUMBER System of Fireproof Floor Construction. Temperature 2190° F., Five Minutes Before Water was Turned In.

Temperature

On the morning of December 19th, at 10:00 a. m., the fire was started with a normal temperature of 32 degrees Fahrenheit. The temperature readings of furnace were obtained by a Le Chatilier Pyrometer placed in the chemical laboratory approximately 100 feet from the furnace and connected to a thermo-couple by No. 14 gauge wire. The temperature readings were made every three minutes.

The fuel consisted of thoroughly seasoned pine and oak wood. Conditions were such that very excellent draft existed, thus obtaining the desired 1700 degrees of temperature at 10:18, or 18 minutes after the fire was started. By referring to diagram of temperature curve on page 5 you will note the average temperature maintained for four hours and seven minutes was 1900 degrees Fahrenheit, while that required was 1700 degrees Fahrenheit. The maximum temperature was 2408 degrees Fahrenheit, at 2:25 p. m., when water was applied.

Water Test

The water was applied through a $2\frac{1}{2}$-inch cotton hose attached to the city water plug, which had a hydrant pressure of 65 pounds per square inch. To the hose was attached a regulation nozzle $1\frac{1}{8}$ inches in diameter and by referring to the picture below you will note the force existing when water was turned in.

The stream was applied to the ceiling for five minutes and, unfortunately, allowed to play on one spot on the ceiling for a considerable length of time. After water had been applied to the ceiling of the furnace for five minutes, it was also applied to the top of the slab by means of a garden hose, and slab thoroughly flooded.

Fire, Load and Water Test on METAL LUMBER System of Fireproof Floor Construction. Temperature 2408° F. Note Water Pressure, 65 lbs. per Square Inch at Hydrant. $1\frac{1}{8}$-inch Diameter Nozzle.

Effect

Where the stream of water was applied to the ceiling and allowed to be directed at one spot for a considerable length of time, the plaster was removed, exposing an area of approximately 2 square feet of Expanded Metal Lath. At other points of the ceiling where it was applied at frequent intervals the second coat of plaster fell off in some cases; but the scratch coat remained wholly intact with the lath completely encased, and on only about one-third of the furnace was the plaster removed at all. In the other two-thirds

of the ceiling area both coats of plaster stayed intact, even though cracks were visible on the under surface. At no time did smoke, fire or water come through the floor.

A careful inspection of the furnace was made at all times. On the west side large cracks appeared, but did not in any way damage the stability of the structure.

Deflection

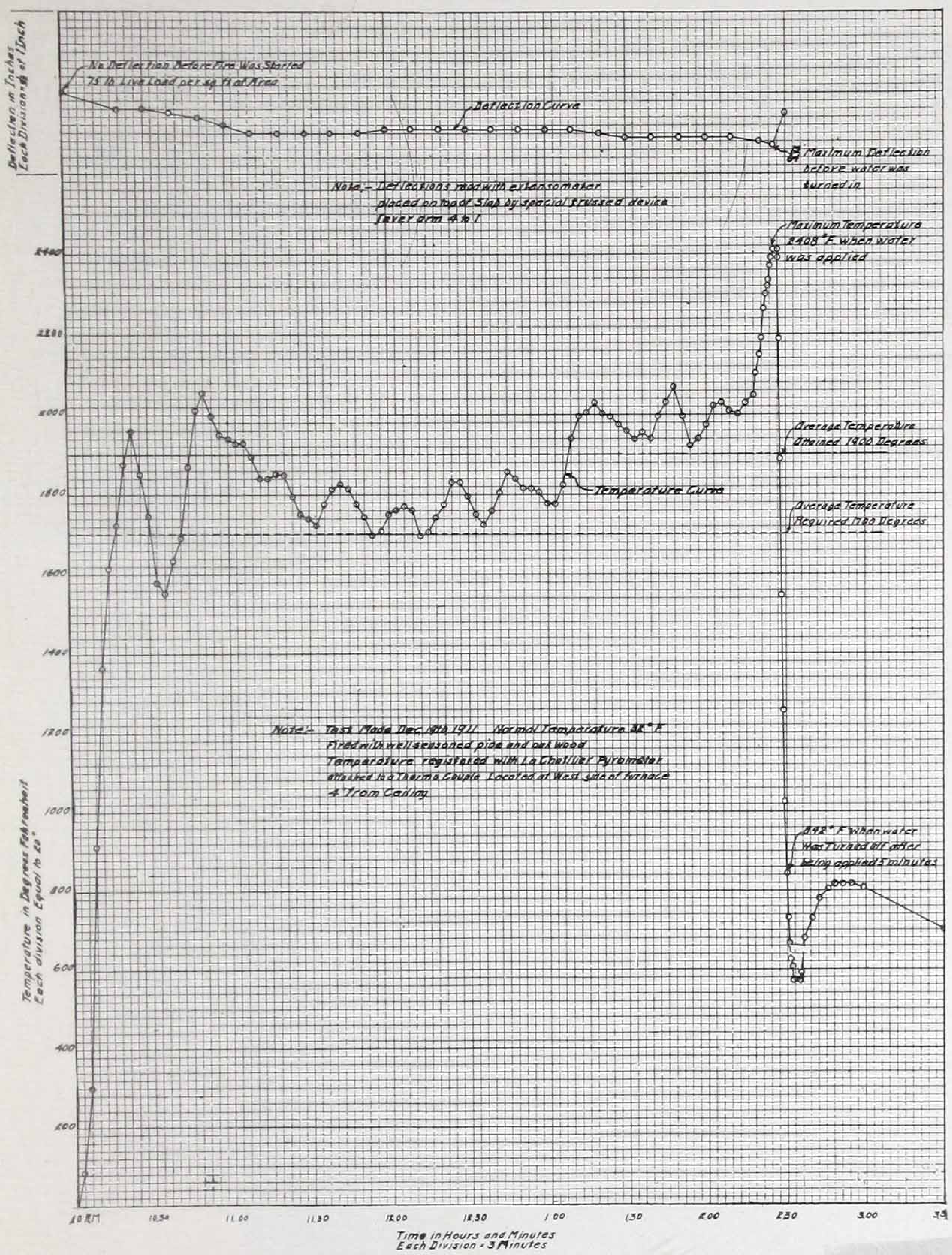
Careful reading of the extensometer every ten minutes showed a maximum deflection of 13/64 of an inch when the temperature was 2408 degrees Fahrenheit. This deflection was read at 2:25, immediately before load, and a maximum deflection of 9/64 of an inch registered. On account of inability to load the slab further with material at hand it was decided to discontinue loading.

Fire, Load and Water Test on **METAL LUMBER** System of Fireproof Floor Construction. Water Directed on the Ceiling.

water was applied to the ceiling. At 2:30, when water was turned off, the deflection was reduced to 5/64 of an inch. By referring to deflection curve on page 5 you will note that same varied in direct proportion to the temperature of the furnace.

On the following day the slab was loaded to 480 pounds per square foot, or 6.4 times the required live

Results of this test prove conclusively the fireproof qualities of METAL LUMBER system of construction. The insulating value of a dead air space surrounding the metal structural members has proven much superior to the insulating features of tile and concrete applied directly thereto.



Temperature and Deflection Curves of Fire, Load and Water Test.

Note Relation of Temperature and Deflection Curves

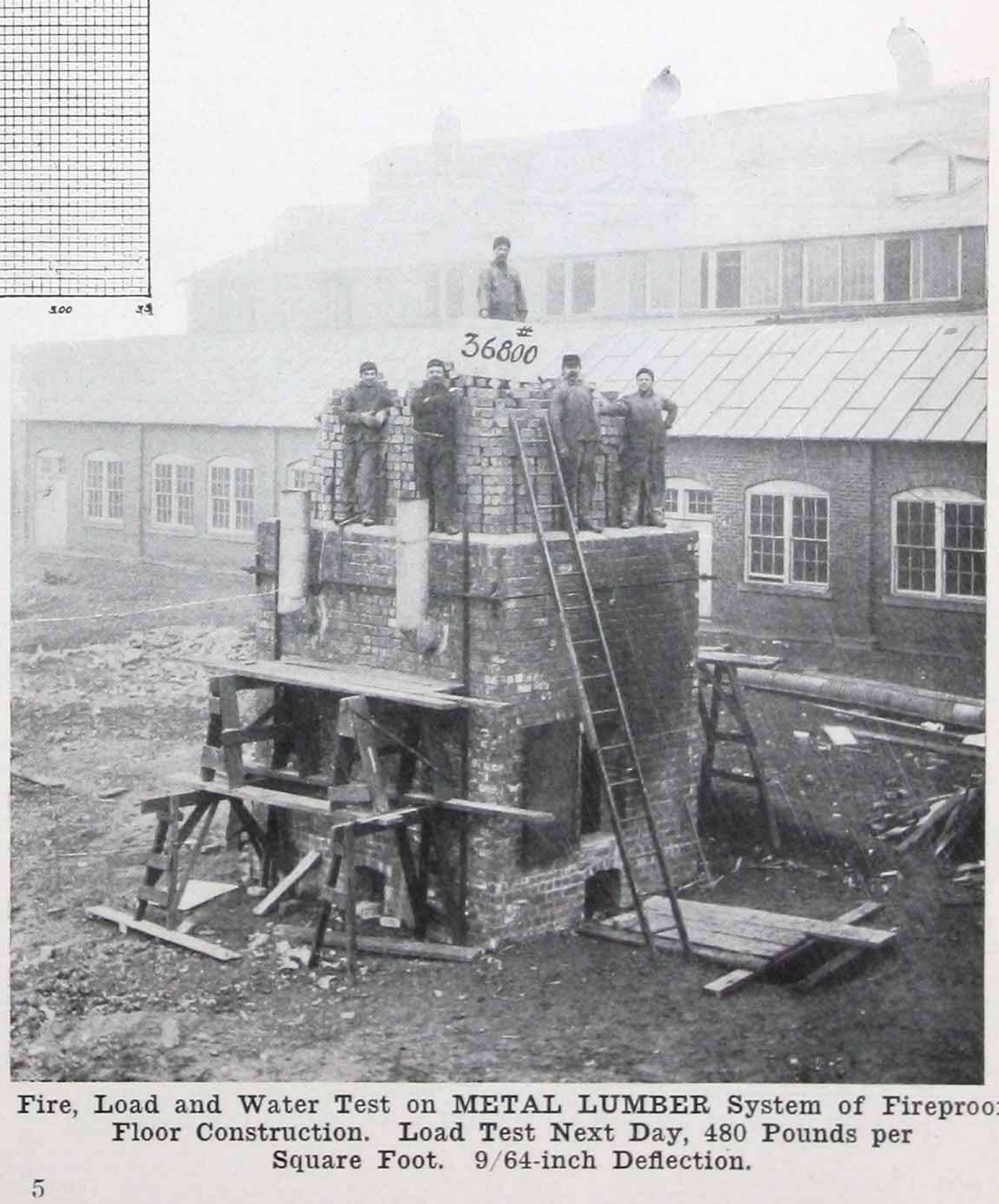
Careful reference to the temperature and deflection curves shown on this page will reveal very interesting information.

It will be noted that the deflection curve is directly proportional to and acts in direct harmony with the temperature curve. When the temperature increased, the deflection increased; when the temperature was stationary, the deflection was stationary; when the temperature decreased, the deflection decreased.

The application of water at the end of four hours reduced the temperature to 842 degrees Fahr., and likewise reduced the deflection to 5/64 of an inch below that which existed before the fire was started.

This remarkable result conclusively proves the theory that internal stresses are removed from Berger's Metal Lumber pressed steel sections, and shows that the joists supporting the loads retain their life and tenacity at all times, even under most severe conditions. This result is made possible by the dead air space insulation protecting the web which contributes a large percentage of the resisting inches of the section, and by the fact that the steel is of such physical and chemical make-up that only a very, very high degree of temperature will affect its efficiency.

Extensive tests show that internal temperature between the joists, the plaster and the concrete does not exceed a certain degree when the temperature in the furnace beneath the joists and separated by 1 inch of plaster is 1700 degrees for four hours. At this temperature the strength of the joists is equal to or greater than at normal temperature and which fact the temperature and deflection curves conclusively prove.



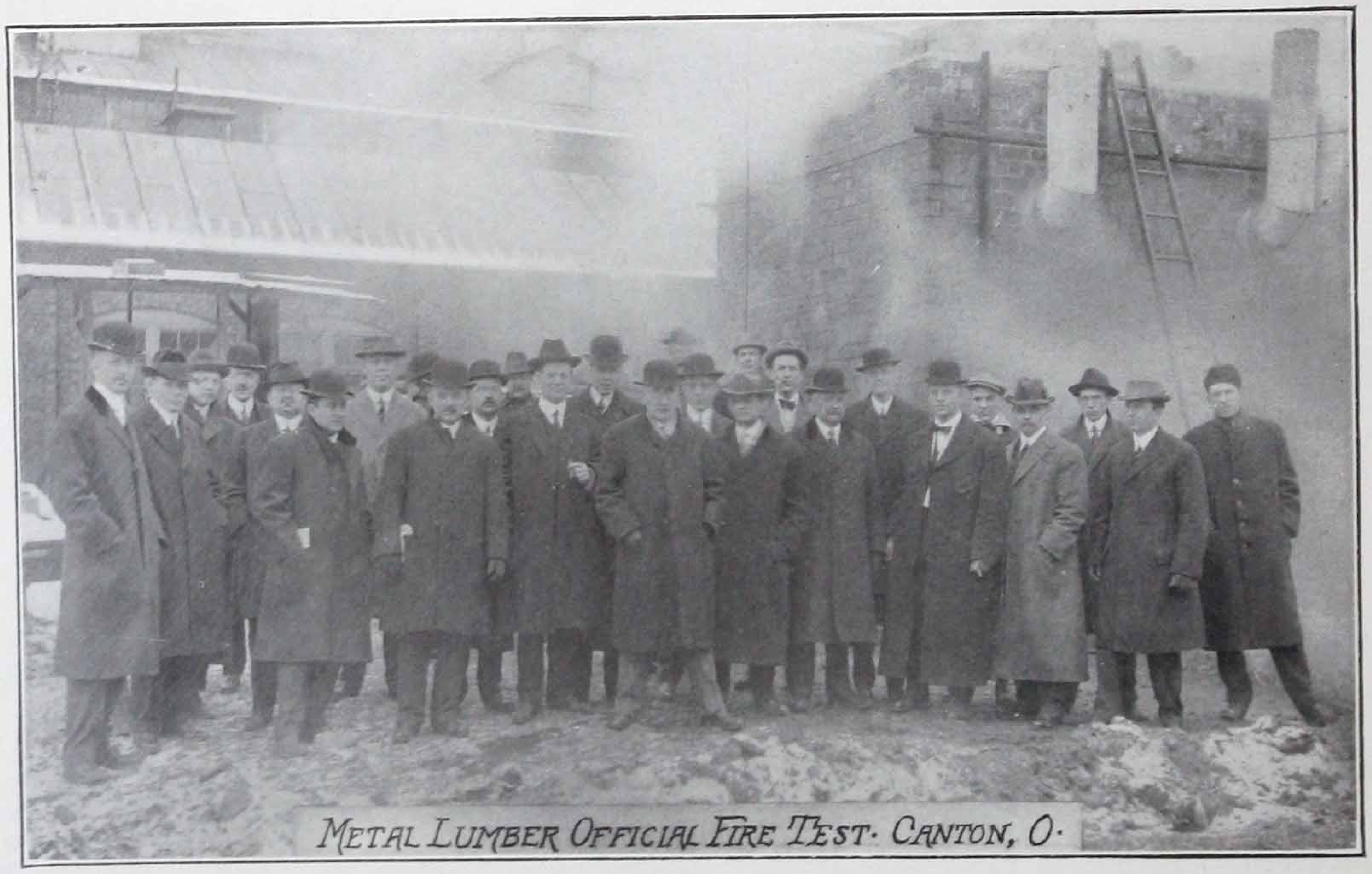
Fire, Load and Water Test on METAL LUMBER System of Fireproof Floor Construction. Load Test Next Day, 480 Pounds per Square Foot. 9/64-inch Deflection.

Test No. 2. (Official)

This Test Was Made by the Canton Laboratories, T. J. Hay, Director, Feb. 24, 1913 Under the Observation of Representatives from the Building Departments of St. Louis, Kansas City, Louisville and Cleveland.

Those Present Were:

J. N. McKelvay, Building Commissioner, St. Louis.
F. B. Hamilton, Supt. of Bldg., Kansas City.
W. J. O'Sullivan, Bldg. Commissioner, Louisville, Ky.
Mr. Zessiger, Chief Engr. Bldg. Dept., Cleveland, O.
Henri Rusch, Chief Engr. Bldg. Dept., St. Louis.
Otto J. Kreig, Inspector Bldg. Dept., St. Louis.
Prof. C. Hallenback, Syracuse University, Syracuse, N. Y.
O. C. Talbot, Civil Engr., Kansas City.
O. S. Traber, Architect, St. Louis.
A. H. Tashjian, Civil Engr., Cleveland.
Mr. Garland, Civil Engr., St. Louis.
Ray Crisp, Civil Engr., Akron, O.
R. T. Brooker, Architect, Akron, O.
T. C. McKee, Contracting Engr., Cleveland, O.
James T. Glover, Boston, Mass.
John Lorenz, Philadelphia, Pa.
R. W. VanHorn, Consulting Engr., New York City.



METAL LUMBER OFFICIAL FIRE TEST · CANTON, O ·

Method of Construction

The furnace in which this test was made is the one used in the previous test and described on page 1 and illustrated in detail on pages 8, 9, 10 and 11. The construction of the slab was substantially the same as our standard excepting only that no tile or wood finish was applied on top.

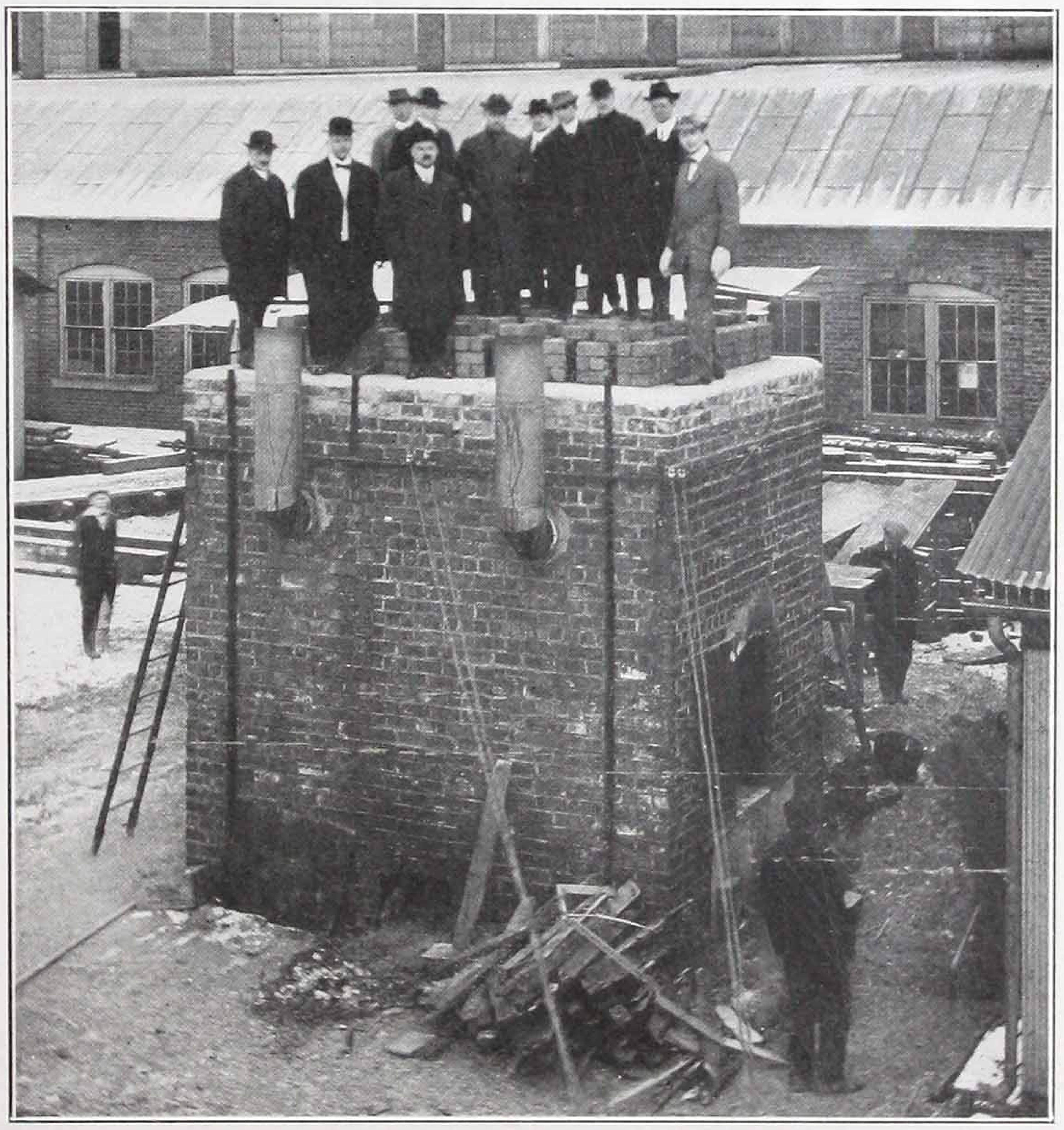
The roof or floor slab which was tested consisted of 6-inch joists, spaced 16 inches center to center and spanning the 12 foot dimension of the building, giving 10 feet clear span. The joists were diagonally bridged with 1 inch No. 20 gauge galvanized bridging, nailed directly into the webs. A layer of No. 24 gauge Plain Expanded Metal Lath was nailed directly to the top of the joists and the lath covered with a concrete slab

2 inches in thickness. The joists were installed in the furnace on February 14th when the temperature was far below freezing. The 2-inch concrete slab was applied on the Expanded Metal Lath at the same time, and while precautions were taken to prevent the freezing of the concrete it was very difficult to insure this condition. The concrete slab applied on top of lath consisted of one part cement, two parts sand and four parts bank gravel.

To the bottom flanges of joists was applied by means of prongs punched thereon, No. 24 gauge Plain Expanded Metal Lath. The lath was covered with two fire was started, this condition being made necessary by the fact that the test had to be executed on a specified date. The total thickness of the two coats of plaster was $\frac{3}{4}$ of an inch; the first coat being approximately 5/16 of an inch in thickness, while the second coat was approximately 7/16 of an inch in thickness and consisted of the same mixture as the scratch coat.

On the top of the furnace was applied, by means of an iron support, an extensometer so designed as to give an accurate deflection reading on the scale as close as 1/128 of an inch.

A small wood fire was started in the furnace imme-



Inspecting the Furnace Before Fire was Started.

coats of cement plaster consisting of the parts listed on page 2.

The first coat of plaster was applied on the lath on February 20th; the second or final coat was applied on the afternoon of February 21st; leaving only seventy hours from the time the plaster was applied until the diately after the second coat of plaster was applied, and a temperature of approximately 75 degrees maintained. Sixty-five hours after the plaster was applied the roof was loaded to 100 pounds per square foot with paving blocks. The load was applied in a uniform manner throughout the supporting area of the roof.

Detail Plans of Construction Tested

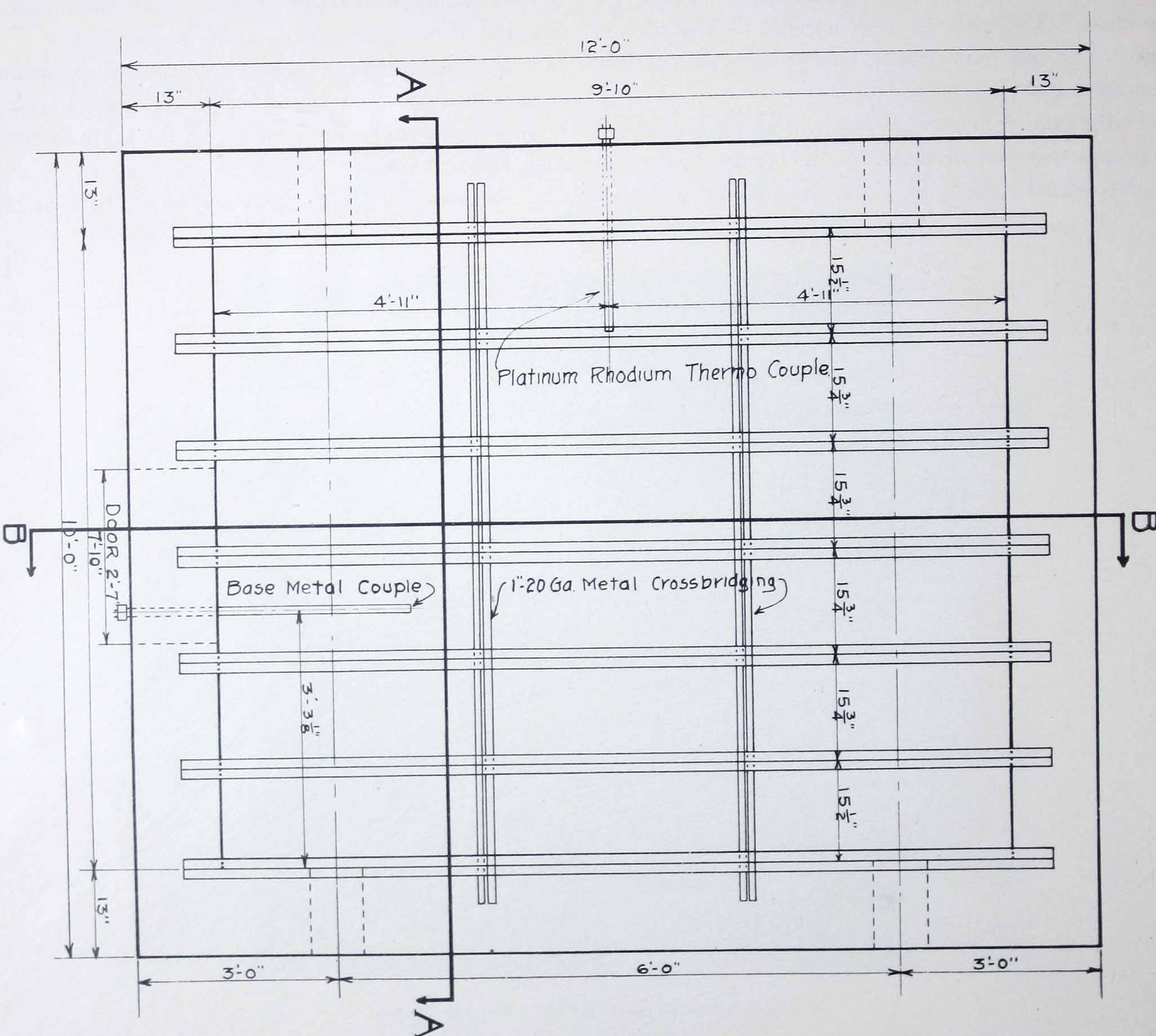
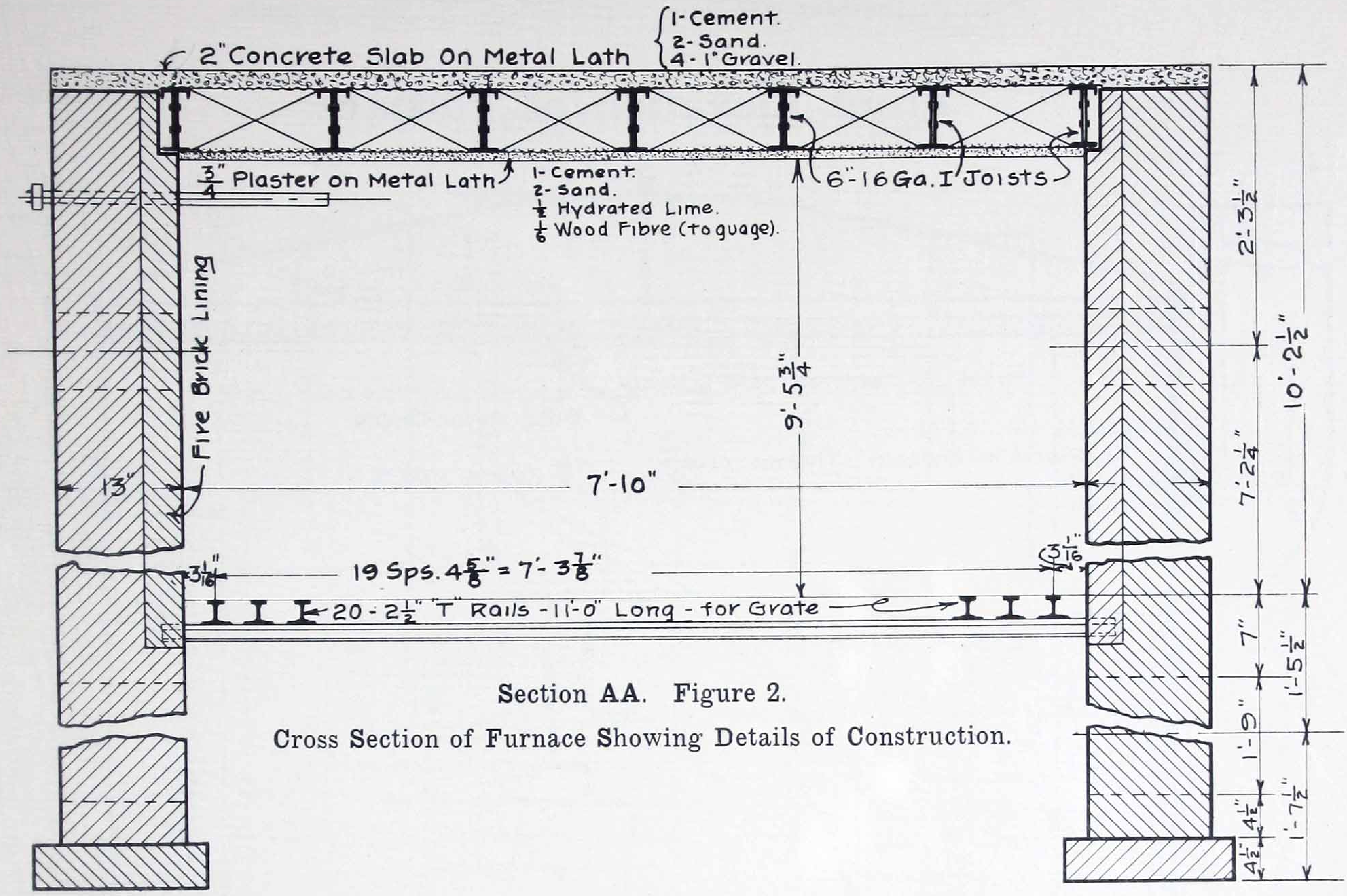
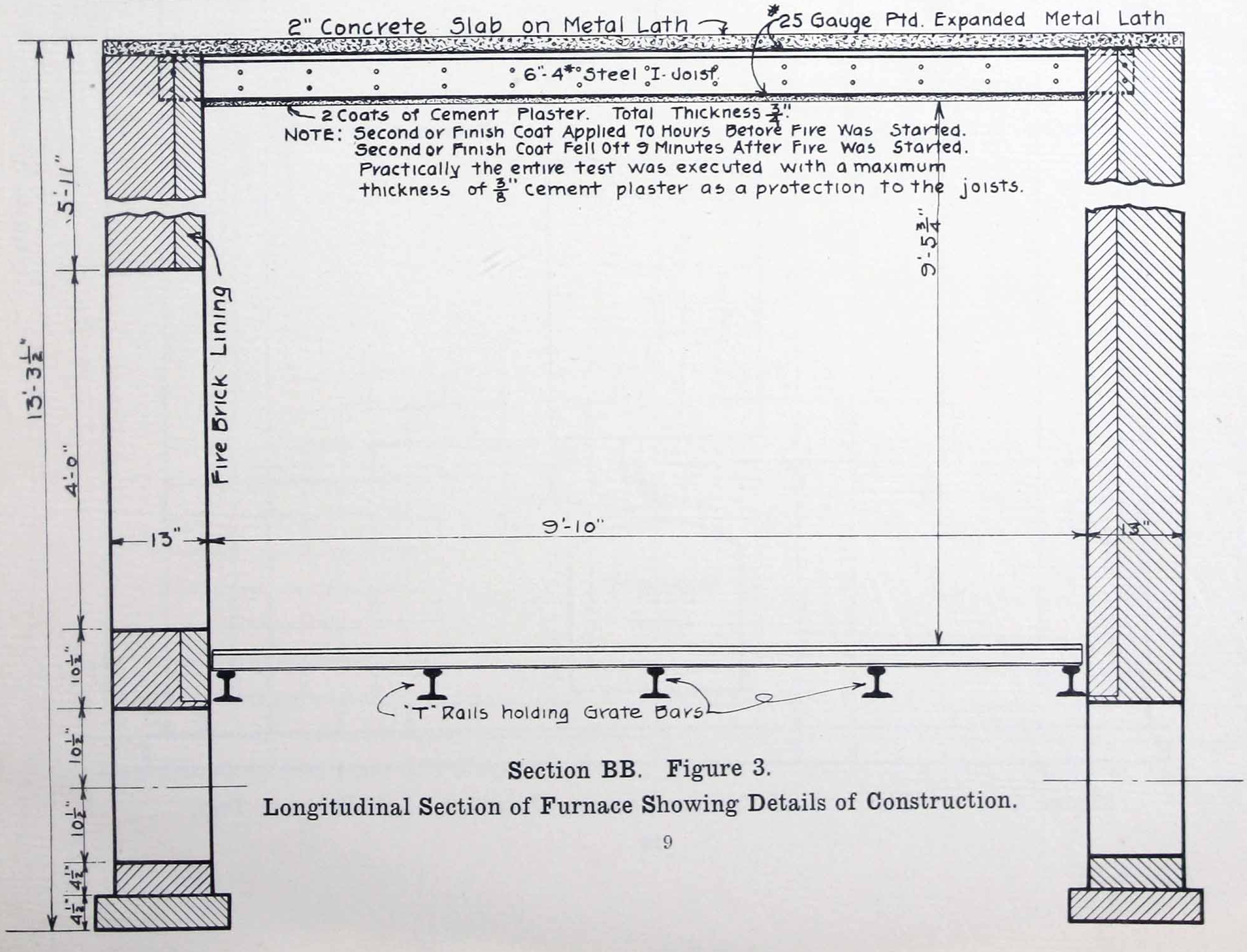


Figure No. 1. Plan of Floor Construction Showing Location of Joists.



Section AA. Figure 2.

Cross Section of Furnace Showing Details of Construction.



Section BB. Figure 3.

Longitudinal Section of Furnace Showing Details of Construction.

Front Elevation of Furnace

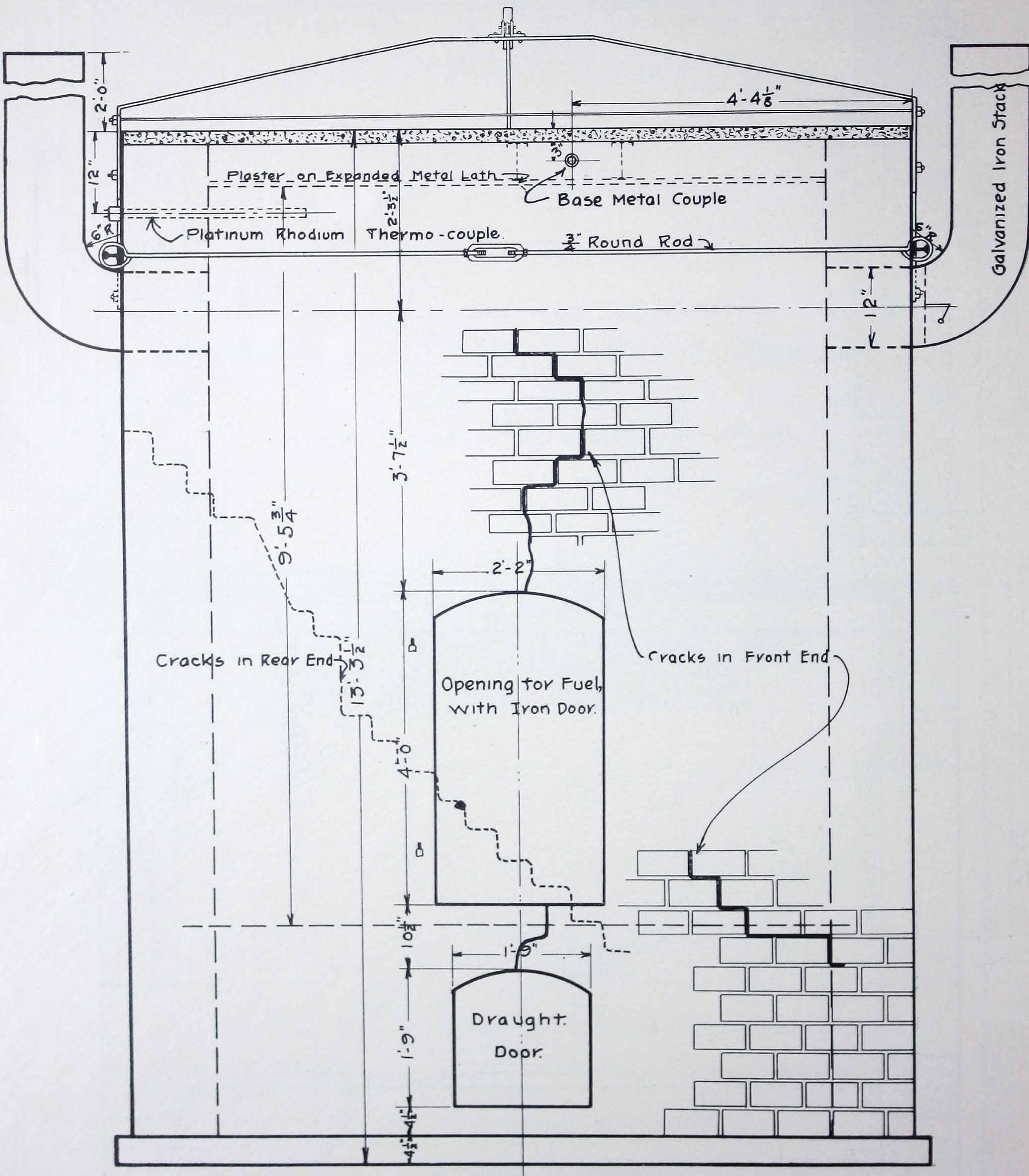


Figure 4—Front Elevation of Furnace Showing Condition of Walls After Test.

Side Elevation of Furnace

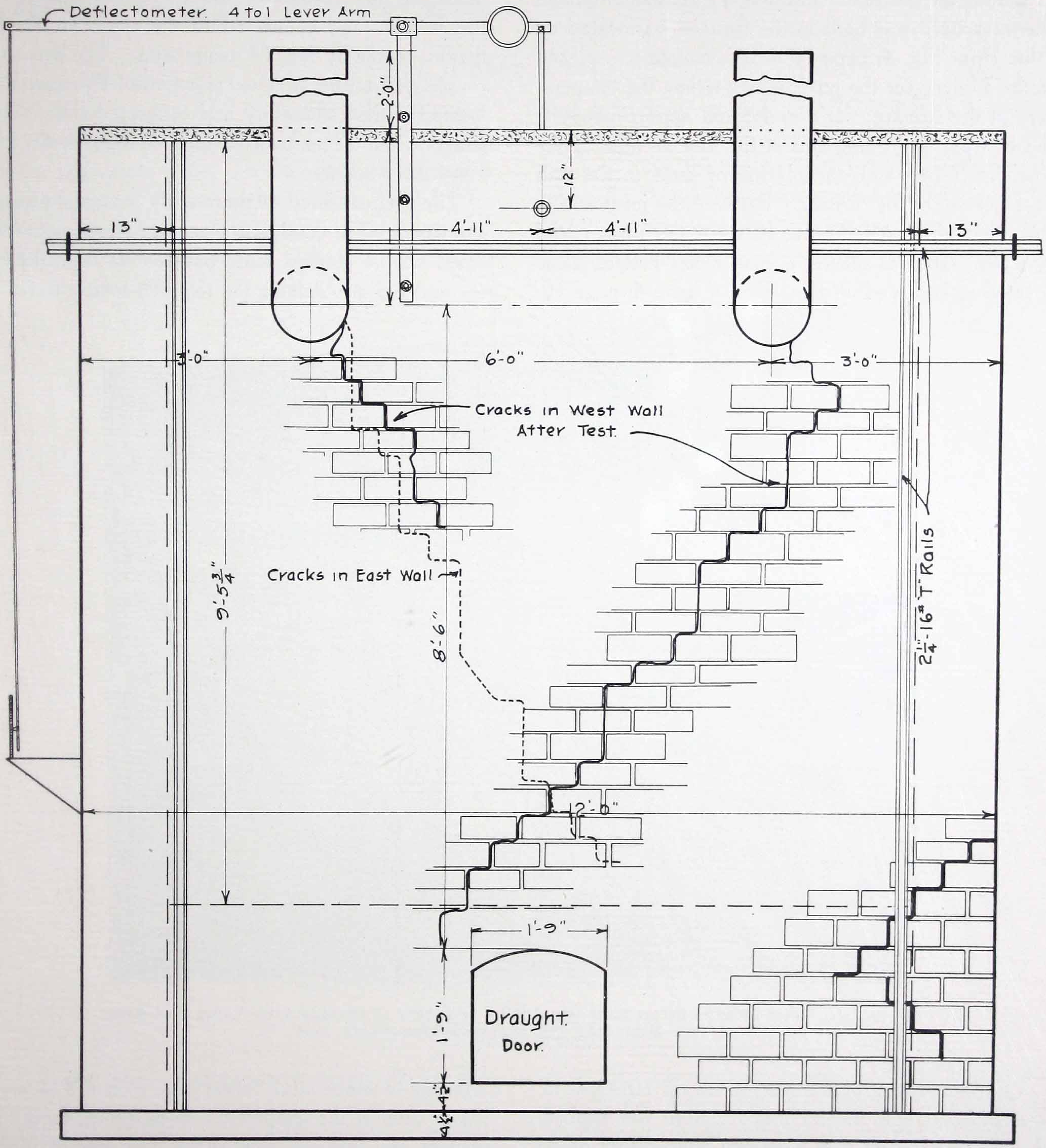
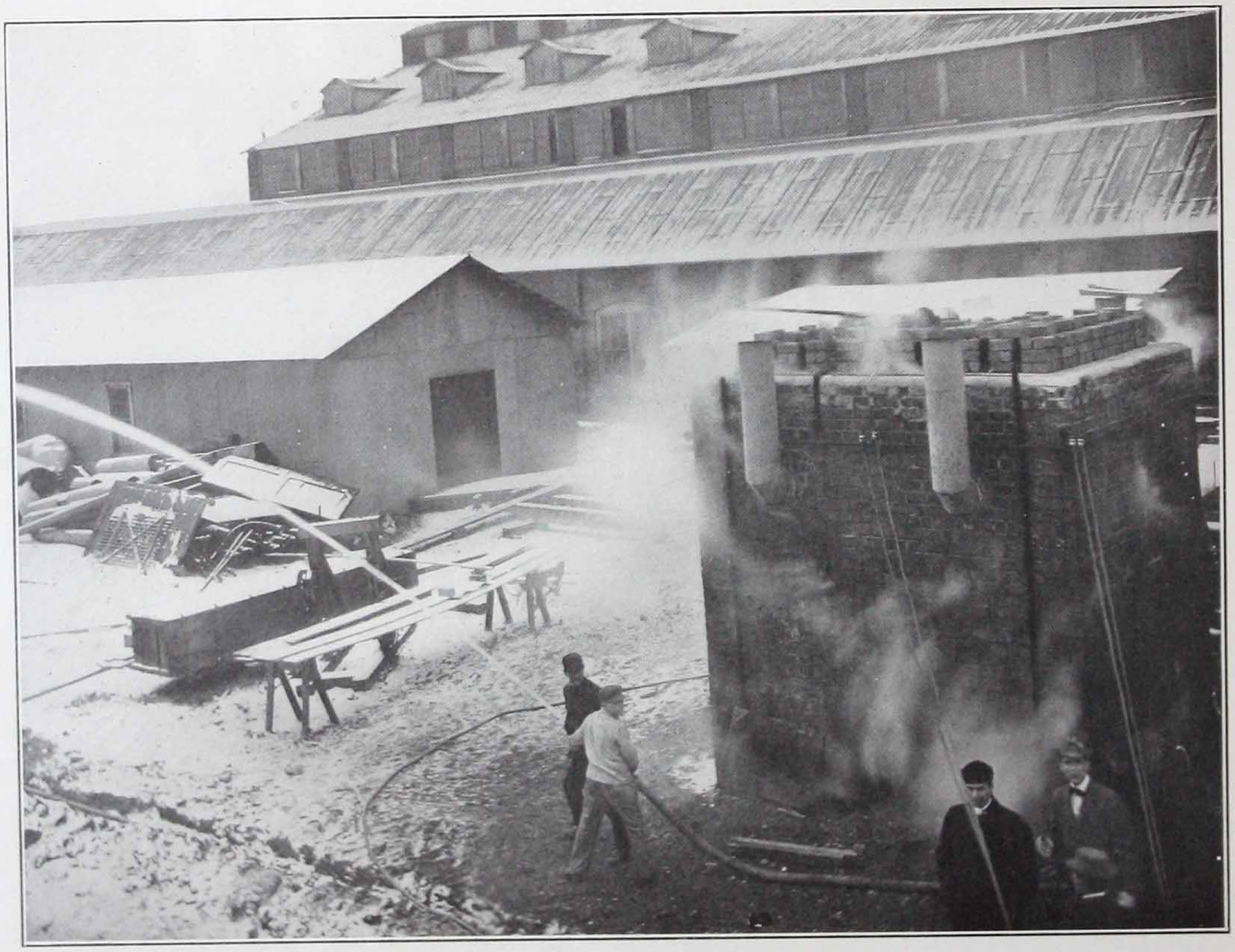


Figure 5—Side Elevation of Furnace Showing Location of Cracks in Walls as Result of Test.

Temperature

During the course of construction a platinum rhodium thermo-couple was built in the furnace, as located on Blue Print Fig. 4, page 10. This couple was placed in the furnace for the purpose of reading the temperature in the furnace. It was located approximately 4 inches from the ceiling and at the side because of the load interfering with the placing of same in the slab in the center of the furnace. Between the joists and in the dead air space existing between the plaster and concrete slab was placed a base metal couple, same located as indicated on Blue Print Figure 4, page 10. placed in the Laboratory about 100 feet distant from the furnace and connected to the platinum rhodium thermo-couple by No. 14 gauge wire. The base metal couple was in turn attached to a Bristol Pyrometer also located in the Laboratory and connected with No. 14 gauge wire. The temperature readings were taken every three minutes.

The fuel consisted of thoroughly seasoned pine and oak wood. The conditions were such that a good draft could not be secured and considerable difficulty was encountered in obtaining the required temperature. By



Testing the Water Pressure Before Same was Applied to Ceiling of Furnace After Latter Had Been Fired Four Hours and Ten Minutes. Temperature 1598° F.

On the morning of February 24th, at 10:45 a. m. seventy hours after second coat of plaster was applied, the fire was started with a normal temperature of 23 degrees Fahrenheit. The temperature readings of furnace were obtained by a Le Chatilier Pyrometer referring to temperature curves page 15 it will be noted that a drop in the temperature occurred at about 700 degrees and this was due to the first coat of plaster falling, causing the fire to be drawn. Careful reference to diagram of temperature curves will give information

on this point. Unfortunately, through a poor connection, it was impossible to read the temperature in the dead air space as the instrument would not register, it afterward being learned that this was due to a poor connection between the couple and Pyrometer.

Water Test

The water was applied through a $2\frac{1}{2}$ inch cotton hose attached to a city water plug, with 65 pounds pressure per square inch. To the hose was attached a regulation nozzle $1\frac{1}{8}$ inches in diameter, and by referring to page 12 you will note the force of the stream.

The water was applied to the ceiling for five minutes at a distance of not more than 10 feet from the end of the nozzle. Approximately 4 square feet of lath was exposed after the stream had been applied for five minutes. Water was then applied to the top of the slab by means of a small garden hose and the furnace thoroughly cooled.

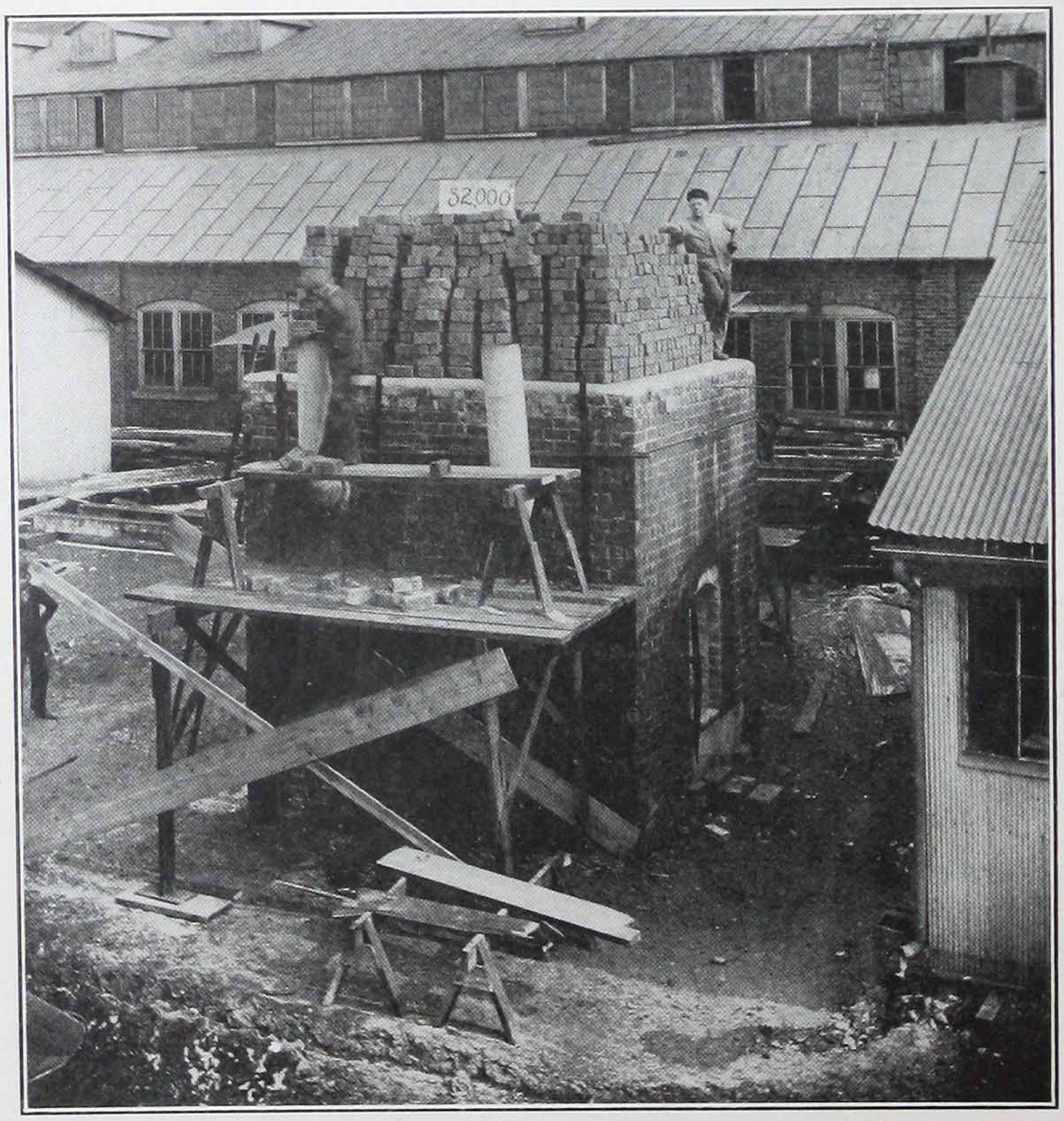
Water Applied to Furnace Ceiling, Pressure 65 lbs. per Square Inch at Hydrant and Carried by $2\frac{1}{2}$-inch Cotton Hose with $1\frac{1}{8}$-inch Nozzle.

Load Test

The next day, approximately twenty hours after the fire test was made, a load test was executed. This consisted of applying paving bricks on top of the furnace and carefully reading the deflection. Deflection can be readily noted by referring to deflection curves, page 15. The roof was loaded to a total load of 451 pounds per square foot including the weight of the plaster and cement covering on the joists. After the load was removed a set deflection of 1/64 of an inch was registered by the extensometer.

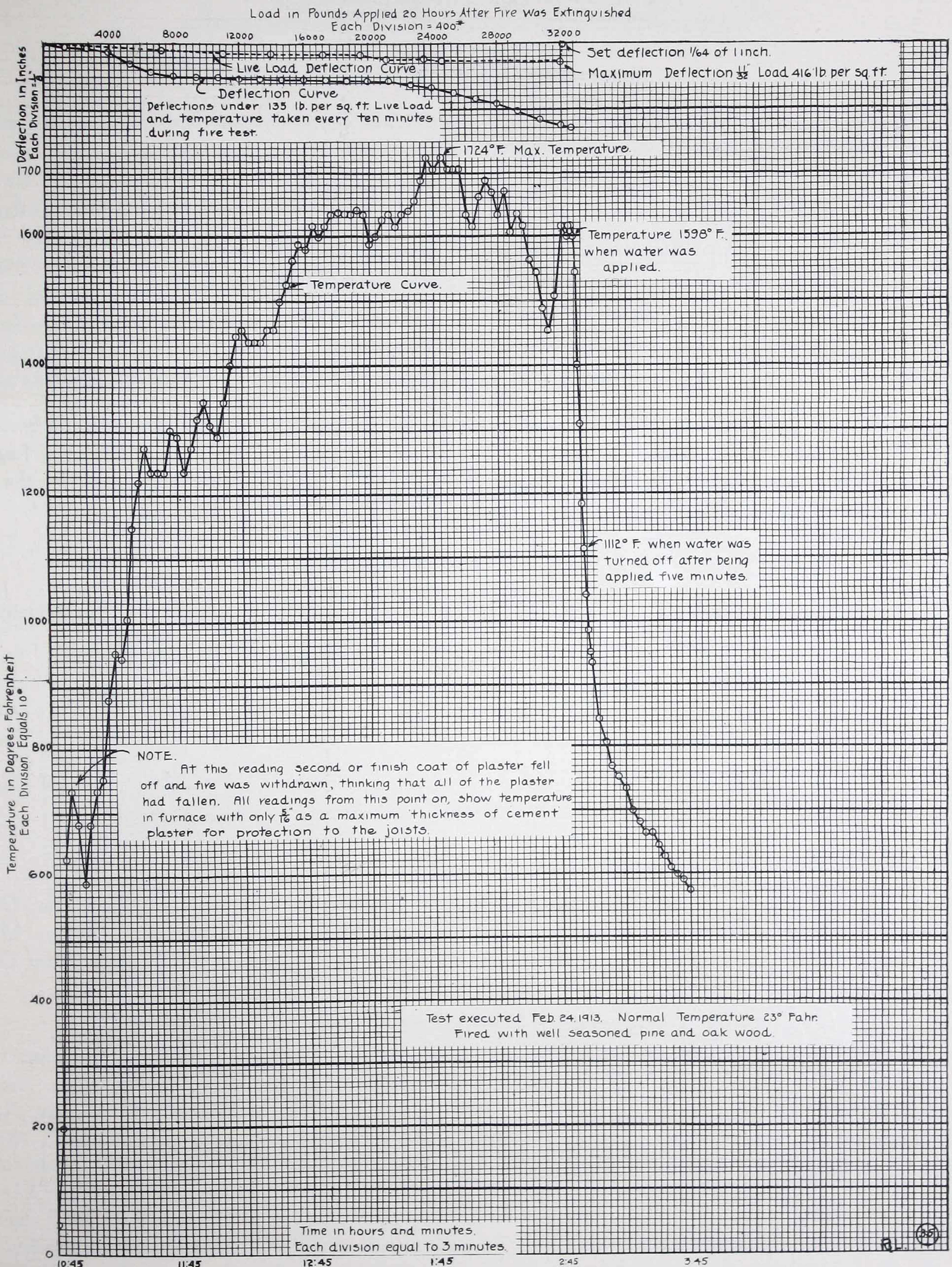
Effect

The effect of this fire, load and water test upon the Metal Lumber floor construction was highly satisfactory; the resistance of the material to the combined test can be considered remarkable in view of existing conditions. This material was tested with no more than 5/16 of an inch of cement plaster applied on the Expanded Metal Lath throughout three-fourths of the area of the ceiling. For material to be subjected to a temperature of more than 1700 degrees Fahrenheit under a load of 135 pounds per square foot, dead and live, with only 5/16 of an inch protection, proves conclusively the merits of the dead air space insulation and the resistance of Berger's special analysis Pressed Steel sections to intense heat. No fire, water or smoke came through the roof (or floor) construction.



Load Test Made Feb. 25th After Fire and Water Tests were Executed.

Temperature and Deflection Curves



TEMPERATURE AND DEFLECTION CURVES OF FIRE LOAD AND WATER TEST.

Test No. 3. (Official)

Conducted by James S. Macgregor, M. S.
In co-operation with the New York City Building Bureaus
April 14 and 15, 1915, at the
Columbia Fire Testing Station, Greenpoint, Brooklyn, N. Y.
Robert W. Boyd, Consulting Engineer

Both installation and test were witnessed by officials from the Bureaus of Buildings of the several boroughs. Floor and ceiling examined just before starting fire. The ceiling contained one small crack, extending from the back of the chamber forward, three feet from the west beam, also a crack five feet from and paralleling the front wall.

General Observations

Day, fair. Southwest wind. Temperature, 73 degrees F. Test started, 9:51 a. m. Fire extinguished 1:54 p. m. Floor constructed March 10th and 11th, 1915.

List of Officials and Guests Present

Representing the Bureaus of Buildings of Greater New York:

Messrs. George Strehen, Borough of Manhattan; H. Sylvester, Borough of Manhattan; E. Wilkinson, Borough of Brooklyn; Thomas Heatley, Borough of Bronx; A. C. Seibert, Borough of Queens.

Representing Various Public Service Departments:

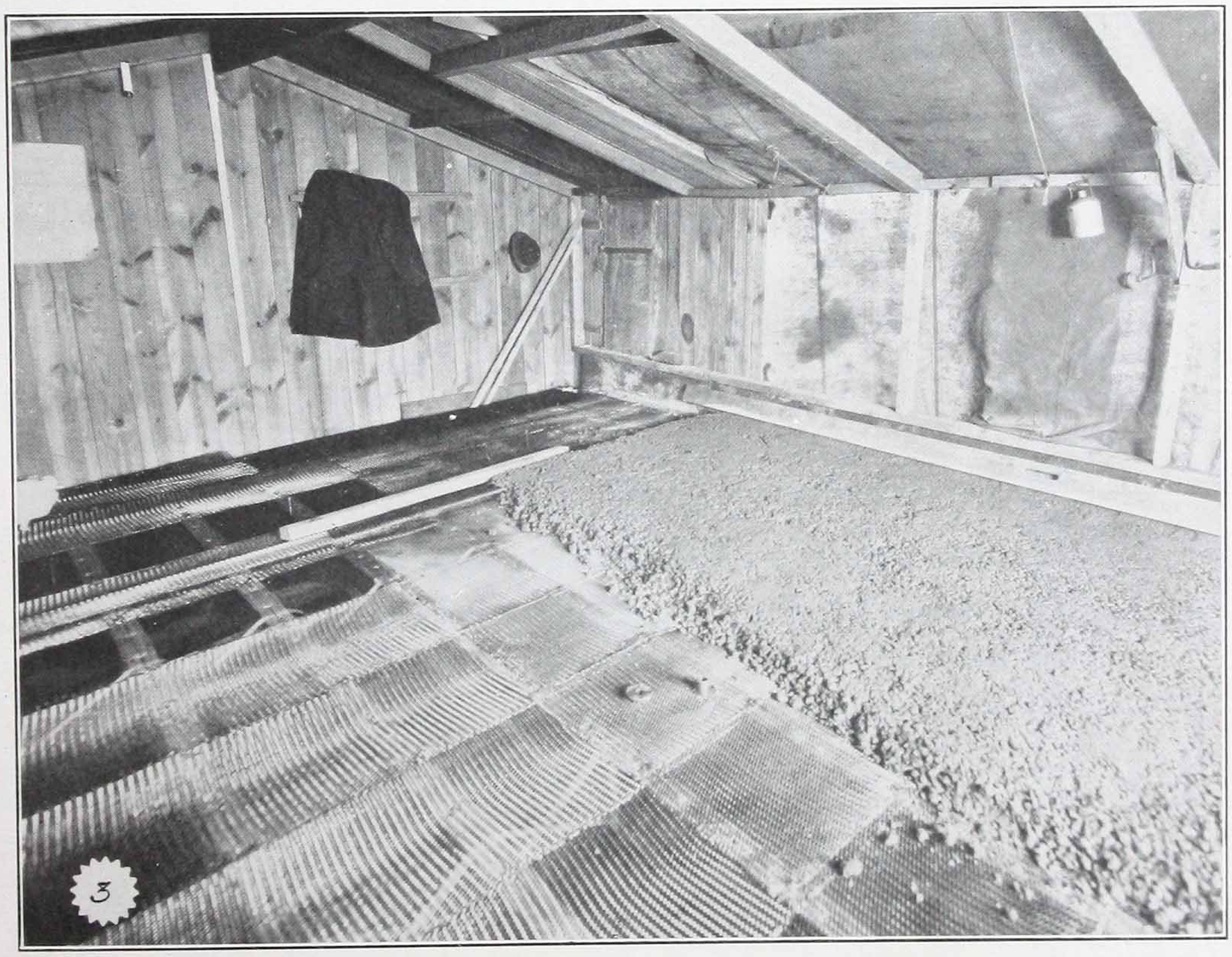
Messrs. Peter C. Spence, New York Dept. of Labor; P. J. Gillespie, New York Dept. of Labor; Daniel J. McDonald, representing Mayor Curley, Boston, Mass.; William H. Woods, City Council, Boston, Mass.; R. E. Goodwin, Public Service Commission, New York City; Peter L. Philippone, Engineer, Building Dept., Newark, N. J.

Among the Other Guests Were:

Messrs. R. S. Allyn, 16 Exchange Place, New York City; F. W. Conner, Construction Specialist, 181st St. and Broadway, New York City; Wm. A. Dykeman, Architect, 15 Exchange St., Boston, Mass.; George W. Francis, 24 State St., New York City; John McClosky, Contractor, Boston, Mass.; J. F. Murray, Architect, 15 Exchange St., Boston, Mass.; Harold Perrine, Columbia University, New York City; S. G. Webb, Secretary Gypsum Industries Association, 17 State St., New York City.

Method of Construction

The test was conducted in a reinforced cinder concrete structure 14 feet x 20 feet on the inside, supplied with suitable chimneys at the top and draft openings through the wall at the bottom. The fire grate located 2 feet 6 inches above the ground level, and the ceiling 9 feet 6 inches above the grate. The floor construction tested formed a temporary roof, consisting of two 12-inch—31$\frac{1}{2}$-pound I beams on 12-inch centers, and having riveted to the webs 3-inch x 2$\frac{1}{2}$-inch x $\frac{3}{8}$-inch angles whose outstanding legs formed the supports for

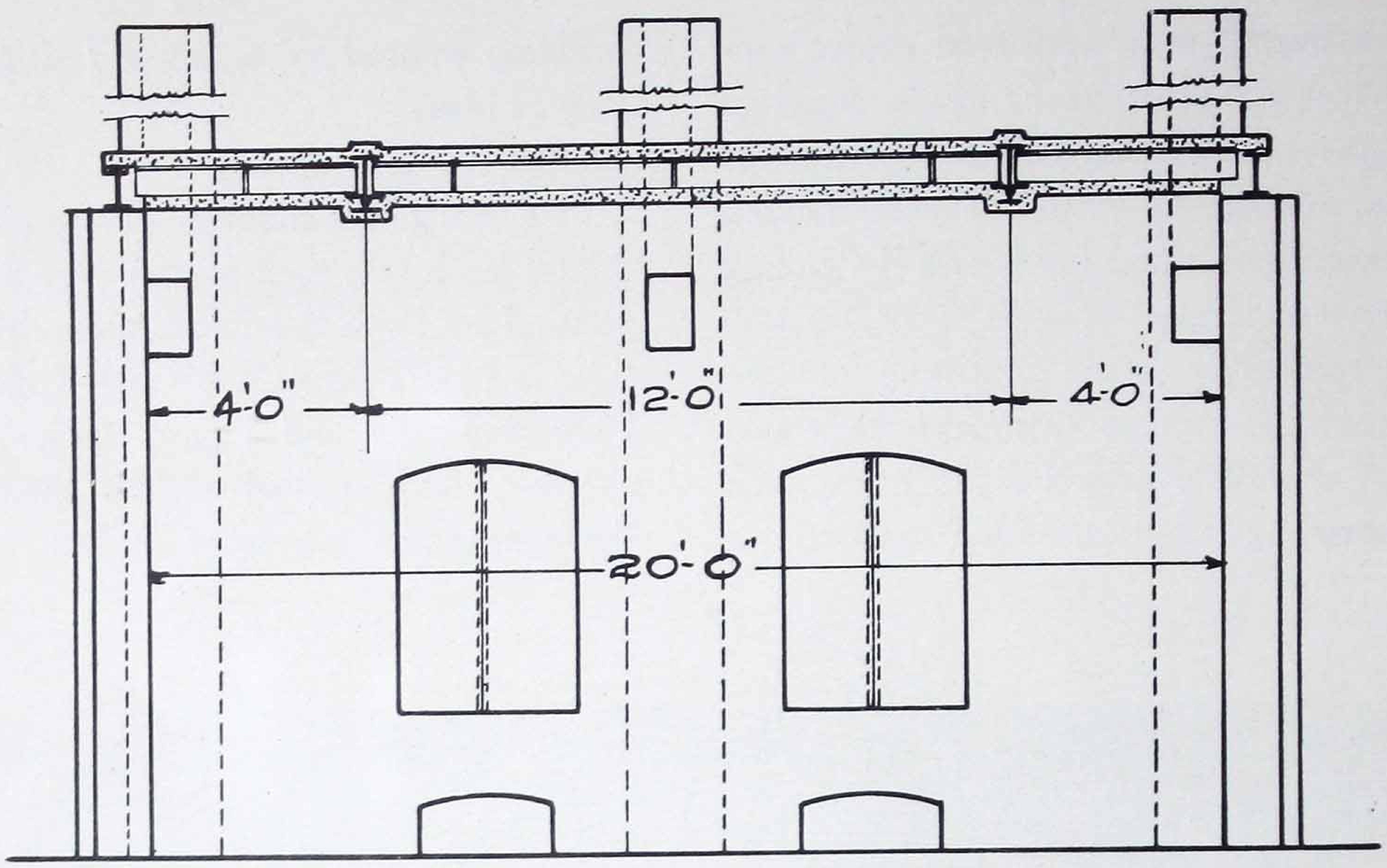


Lath in Place on Top of Joists. Cinder Concrete Partially Poured.

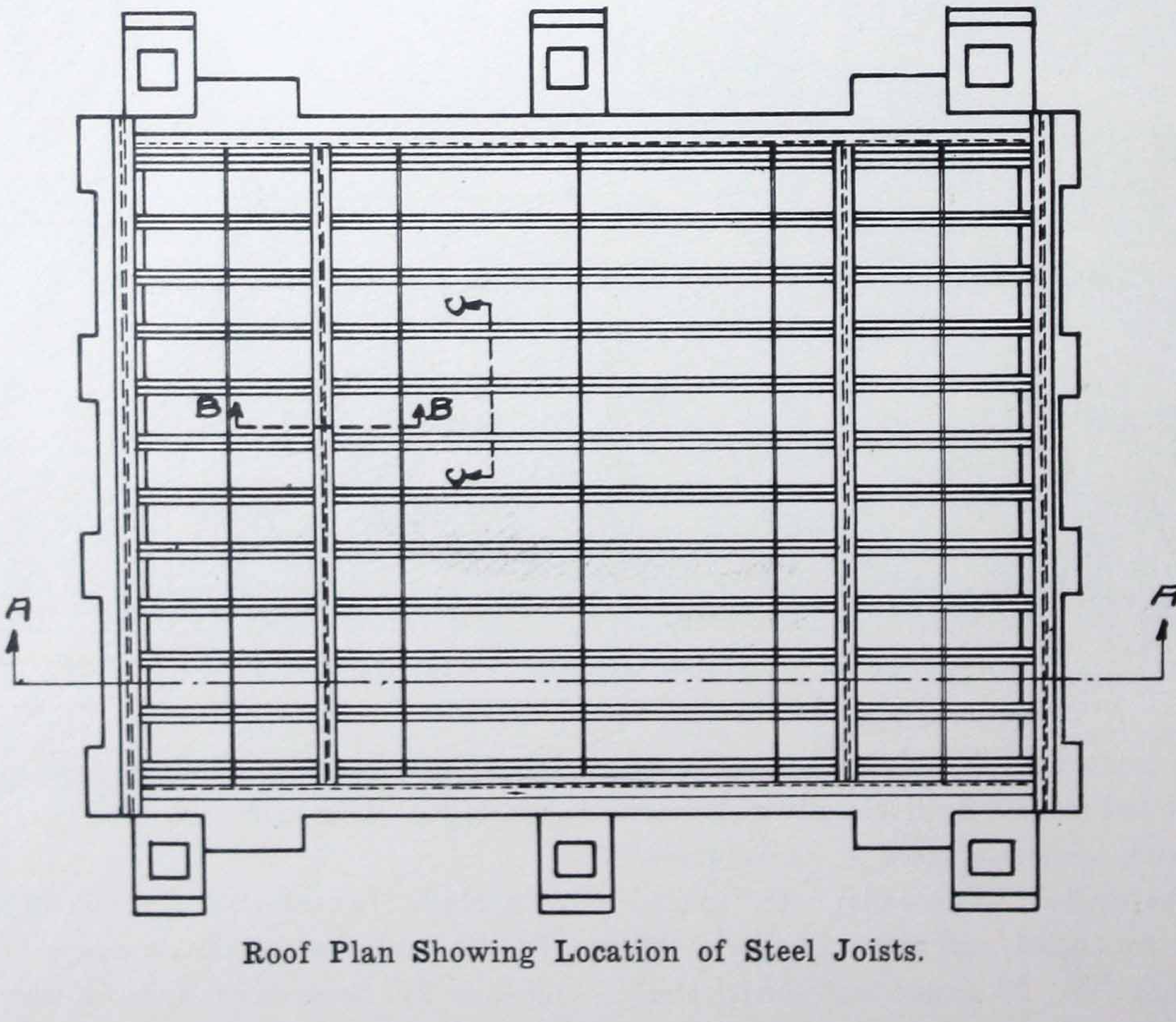
metal joists. The joists were 7 inches deep, made of No. 12 gauge steel and formed by riveting two channel sections back to back with two rows of rivets spaced 7$\frac{1}{2}$ inches center to center. The joists were spaced 15$\frac{1}{2}$ inches center to center and cross bridged with three rows of 1-inch No. 20 gauge galvanized steel bridging secured by means of 6 d. nails driven into the web of joists.

No. 25 gauge painted (Berger's Best) Expanded Metal Lath was then placed over the top of joists and secured by large head 6 d. nails driven into the webs. The top slab consisted of 1 part Edison cement, 3 parts Cow Bay sand and 5 parts cinder mix of a dry consistency, and applied to the thickness of 2 inches throughout the top layer of lath. The ceiling consisted of cement plaster applied on No. 25 gauge painted Expanded Metal Lath.

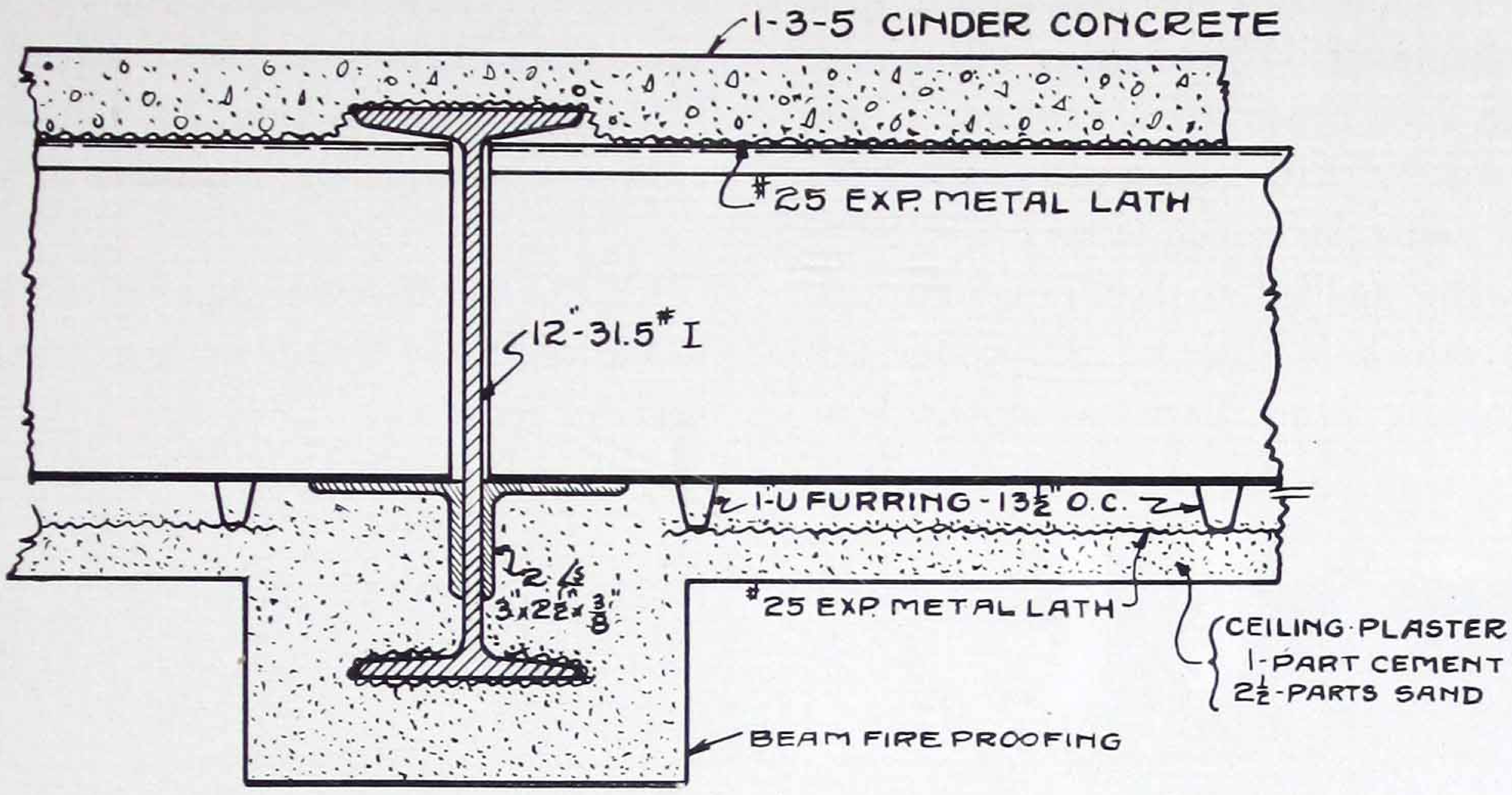
Details of construction are shown in figures on pages 18, 19 and photographs on pages 17, 20, 23, 24, 25, 26 and 27, being views taken during installation.



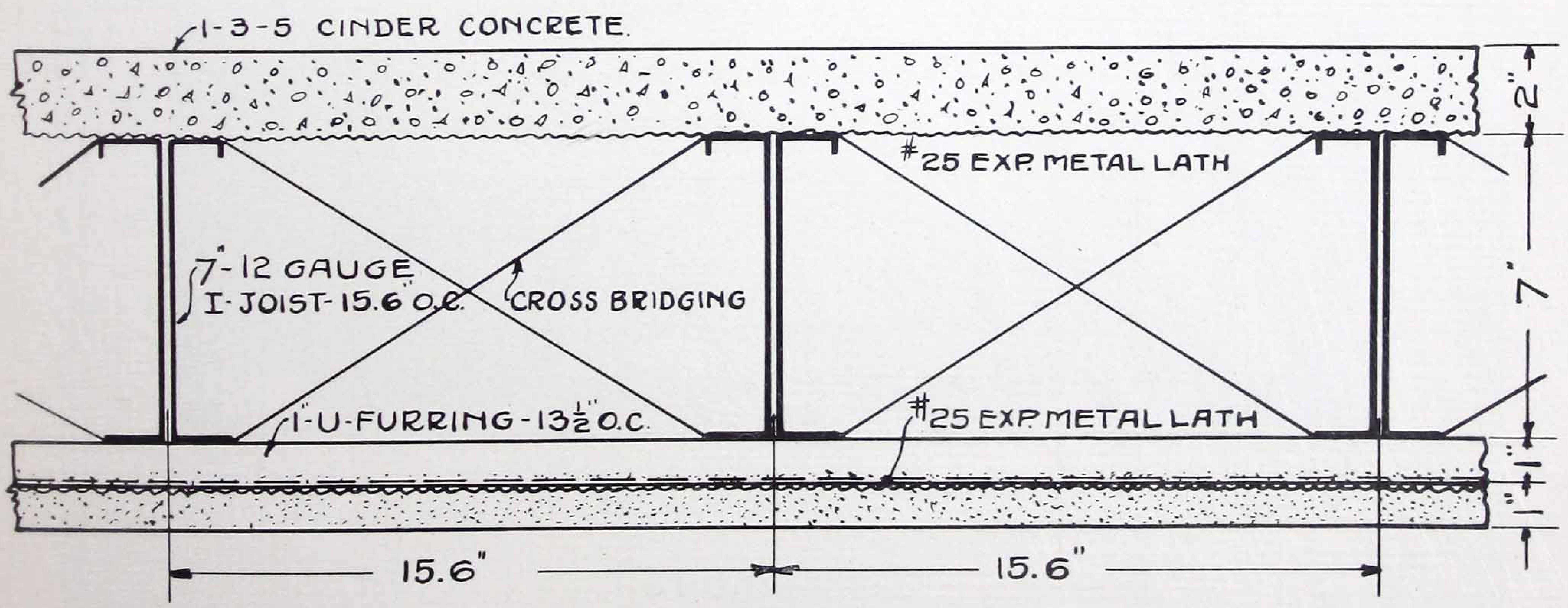
Section AA. Showing Floor Construction as Roof Slab.



Roof Plan Showing Location of Steel Joists.



Section BB. Through Steel Beam Supporting Joists.

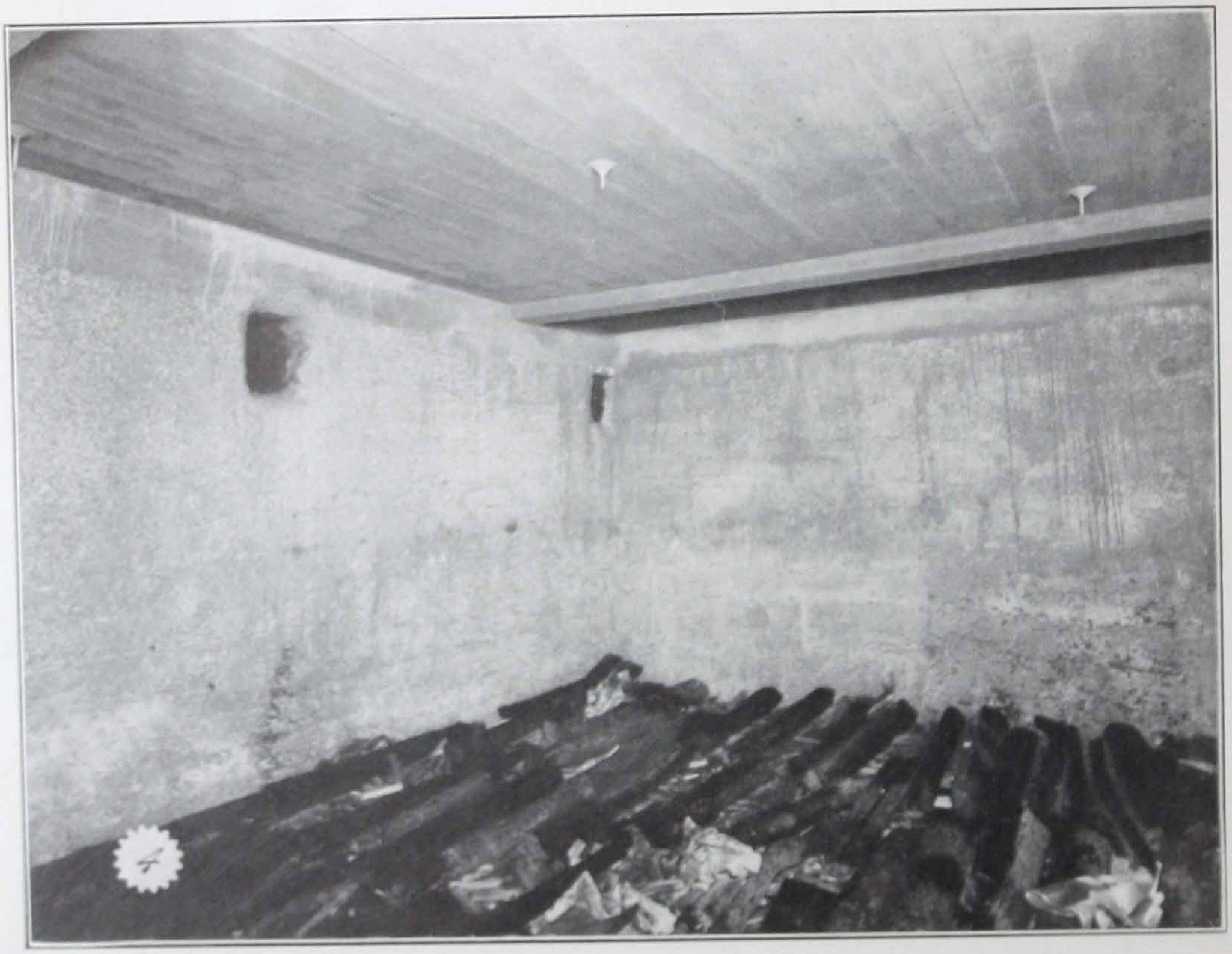


Section CC. Detail of Floor Construction Tested.

Purpose of the Test

The purpose of the test was to determine the effect upon Berger's Metal Lumber System of Floor Construction subjected to continuous fire, regulated to give an average temperature of 1700 degrees Fahrenheit for four hours, the floor construction carrying a uniformly distributed load of 150 pounds per square foot. At the end of four hours the ceiling to be subjected to a stream of cold water applied at short range through a $1\frac{1}{8}$-inch nozzle, with a pressure of 60 pounds per square inch at the nozzle; after which the upper side of the floor was then flooded at hydrant pressure, and the ceiling was again attacked with the 60 pound pressure. The water being applied to the ceiling for ten minutes and to the roof for two and one-half minutes. Deflection of beams and floor construction being measured at fifteen minute intervals.

On the day following the fire and water test the floor to be loaded to 600 pounds per square foot and deflections recorded.



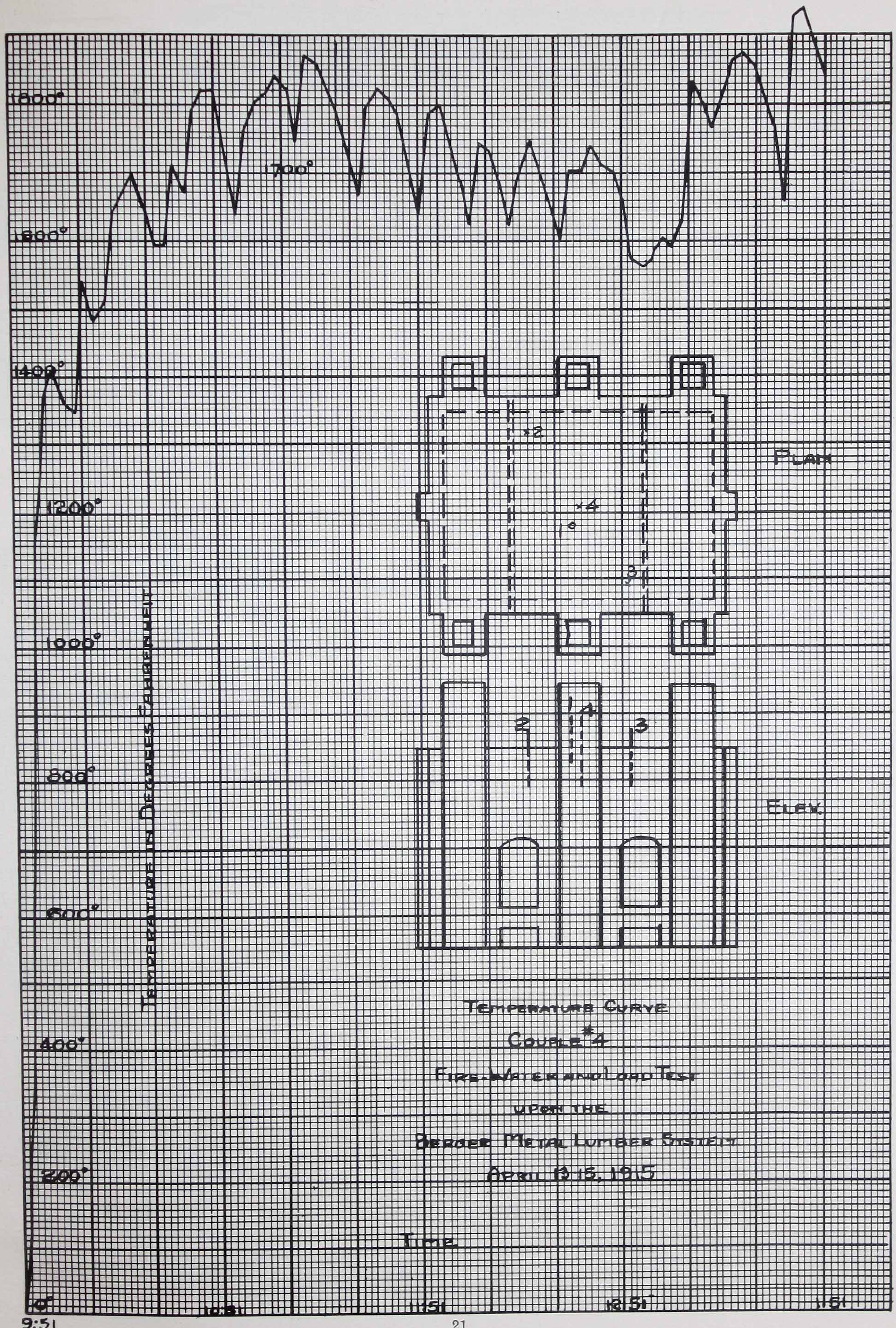
Ceiling just Before the Fire Test. Thermo-couples can be seen Projecting Below the Ceiling.

Temperature

The temperature was obtained by means of thermocouples suspended through the floor with the junction about 6 inches below the ceiling. Refer to photograph above.

Temperature readings were taken every three minutes throughout the duration of fire test. Dry cord wood was used for fuel. Temperature readings together with plotted curves for one couple can be found on page 21.

Temperature Chart

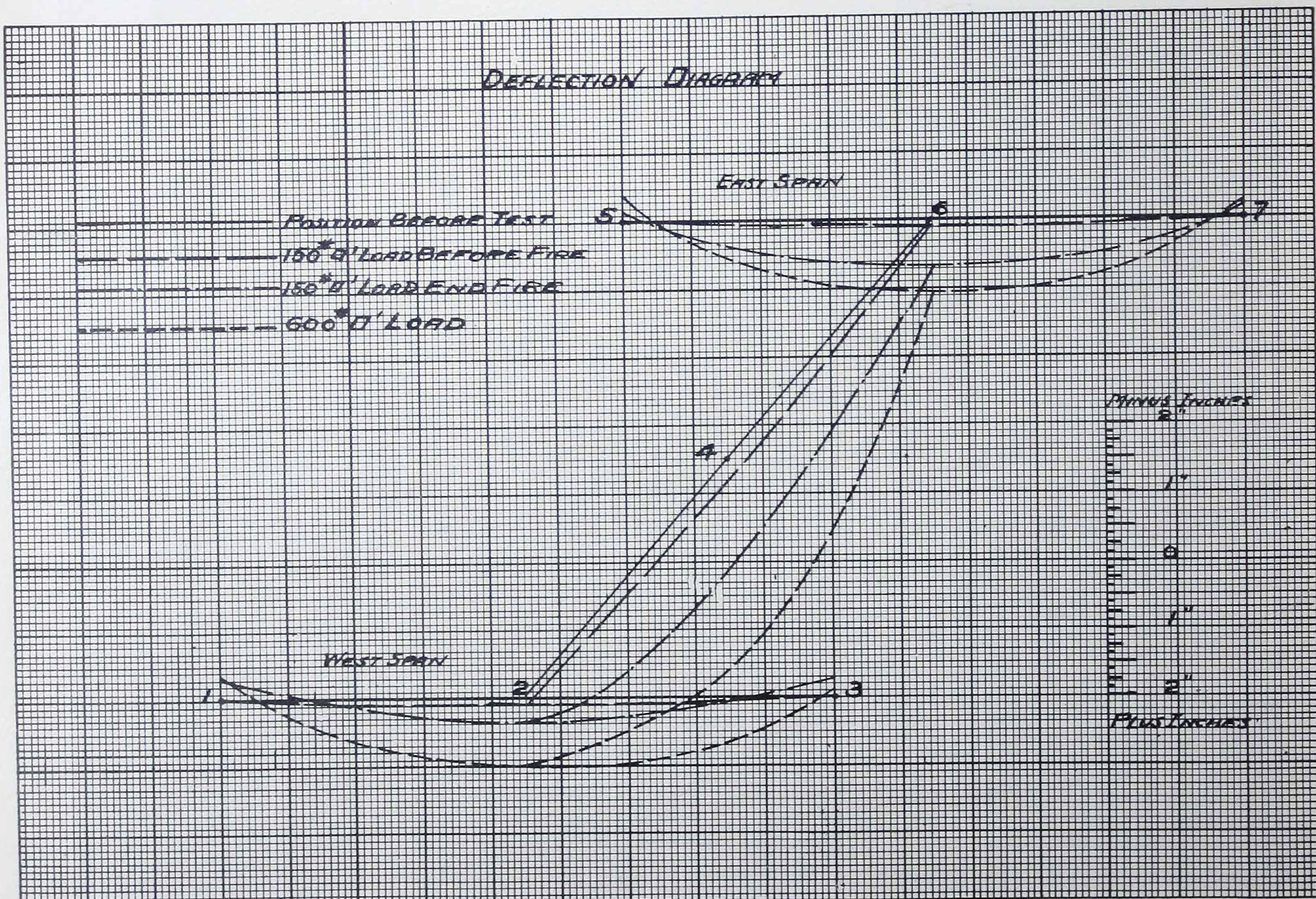


Deflections

Deflections were measured by means of a Y-level, readings taken from rods located at the ends and middle of each beam, and also at the middle of floor construction. The "Table of Deflections" on this page gives full information concerning the variation in level of each station throughout the test.

Water

Water was applied by firemen (see page 25), with an engine detailed from Engine House No. 138, Norman Avenue, Brooklyn. A stream of water was applied by being thrown back and forth and not allowed to play continuously on one spot. The water was applied first to the ceiling for five minutes, then on the top for two and one-half minutes, and again on the ceiling for five minutes.



Deflection Chart.

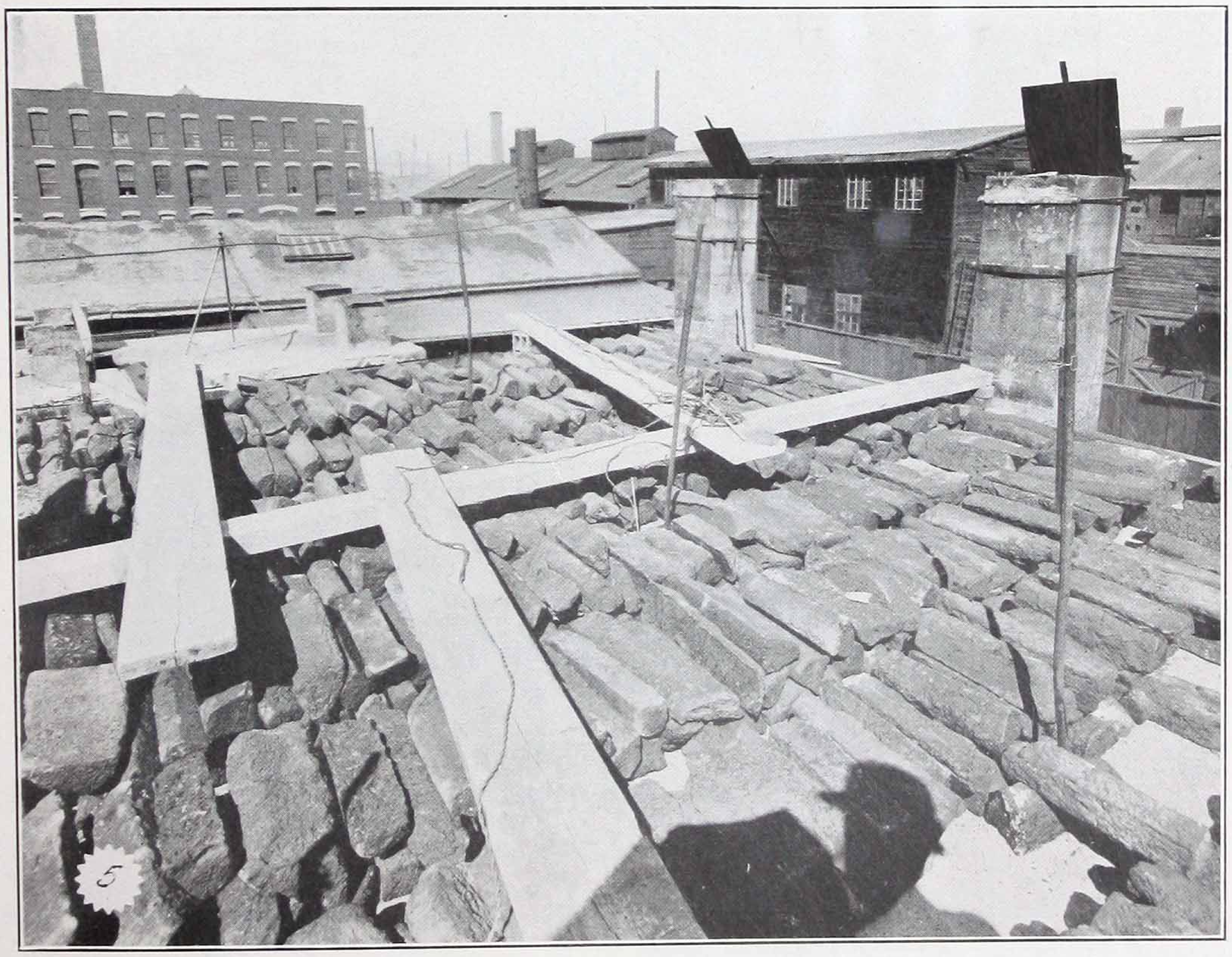
Results of Test

The following observations were made of the condition of the construction during the progress of the test. The elapsed time after starting the fire being given in each case.

After ten minutes. Cracks developed in top slab along the inner edge of both I beams, and also along the back wall of the test house.

ten minutes open approximately $\frac{1}{8}$ inch. A crack started in the southwest corner of the ceiling parallel to and approximately 3 feet from the west beam.

After one hour and twenty minutes. A crack developed paralleling the one above noted averaging 3 inches from the beam protection, extending from the back wall forward for a distance of about eight feet.



Top of Floor Just Previous to Starting the Fire. Load of 150 lbs. per Sq. Ft. in Place.

After fifteen minutes. Ceiling in good condition. The mortar forming the inner edge of the protection for the east I beam toward the front of the test house was forced off. This was not deep, however, and did not expose the furring around the lower flange of the beam.

After one hour. Cracks noted in top slab at end of

After one hour and forty minutes. Numerous small cracks appeared.

After one hour and fifty-five minutes. A bulge was observed in the southwest corner of the ceiling. The point of maximum deflection being some 40 inches from the back wall. This bulge or sag opened up the cracks near it to a width of approximately $\frac{1}{4}$ inch. Sub-

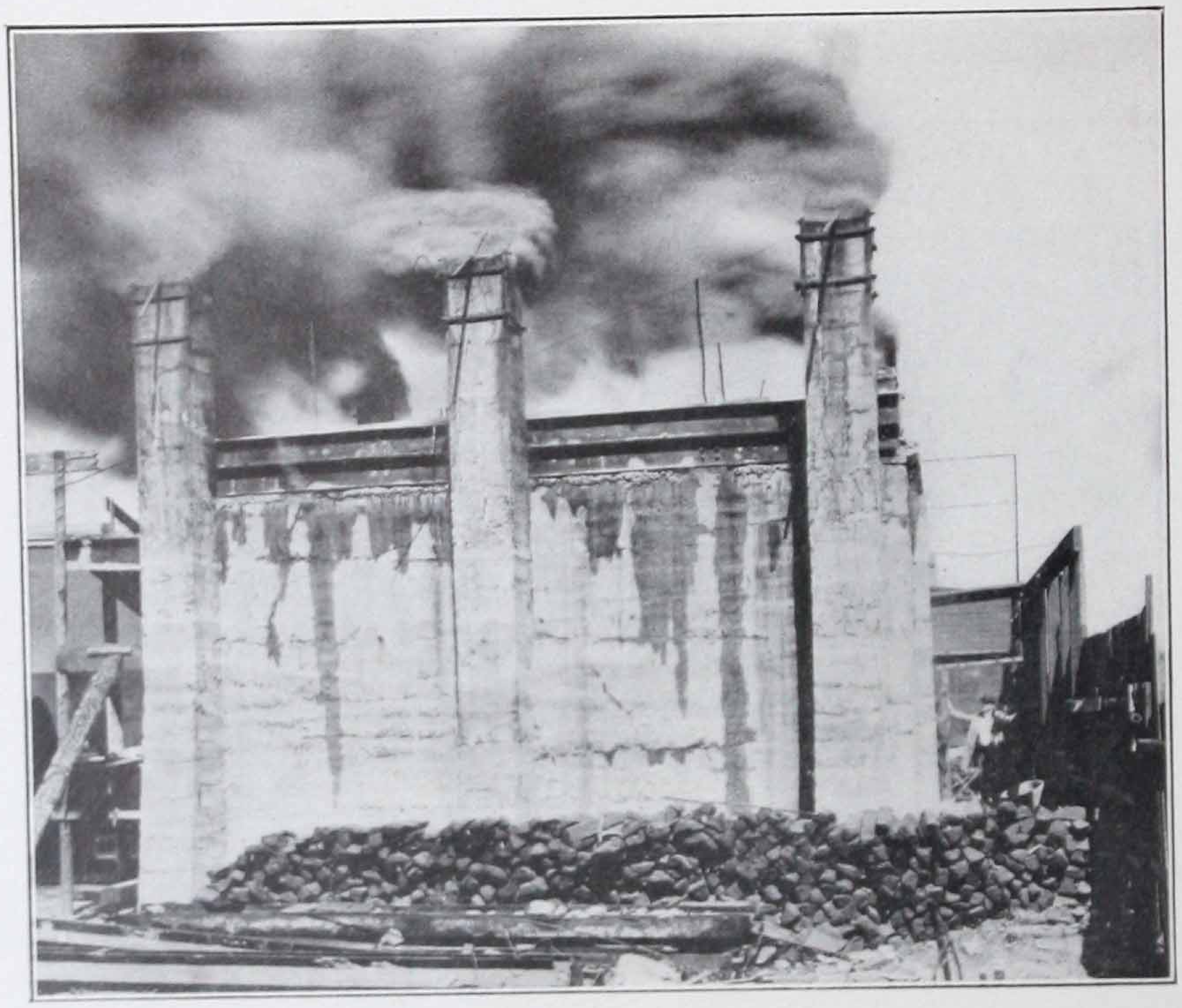
sequent examination of this place showed that the wire attachment to the furring strip holding up the ceiling was broken or cut under three continuous joists. It is hard to explain why this should have occurred as the wire in all other connections was in good condition.

It is well to note in this connection events that occurred during installation and preparation for test: On March 27th, eighteen days previous to the test, the wood superstructure protecting the test building from weather during installation of material was totally destroyed by fire. The fire was finally extinguished with application of water by the Fire Department. Subsequent investigation twelve hours after the fire revealed the fact that water to the depth of $\frac{5}{8}$ of an inch still remained on top of ceiling plaster.

This fire and numerous other events strongly indicate an effort was made by someone to have the construction fail under test.

After two hours and twenty-five minutes. A slight flow of smoke was observed issuing through the crack along the top of the west beam. The amount escaping was small; in fact at times it was hardly perceptible. This continued to the end of the fire test.

After two hours and forty minutes. A crack started in the upper slab three feet from and parallel to the back wall. Nothing more of importance developed up to the application of water.



Test House During the Fire.

After four hours. The temperature recorded in the air space between slabs was 1046 degrees F.

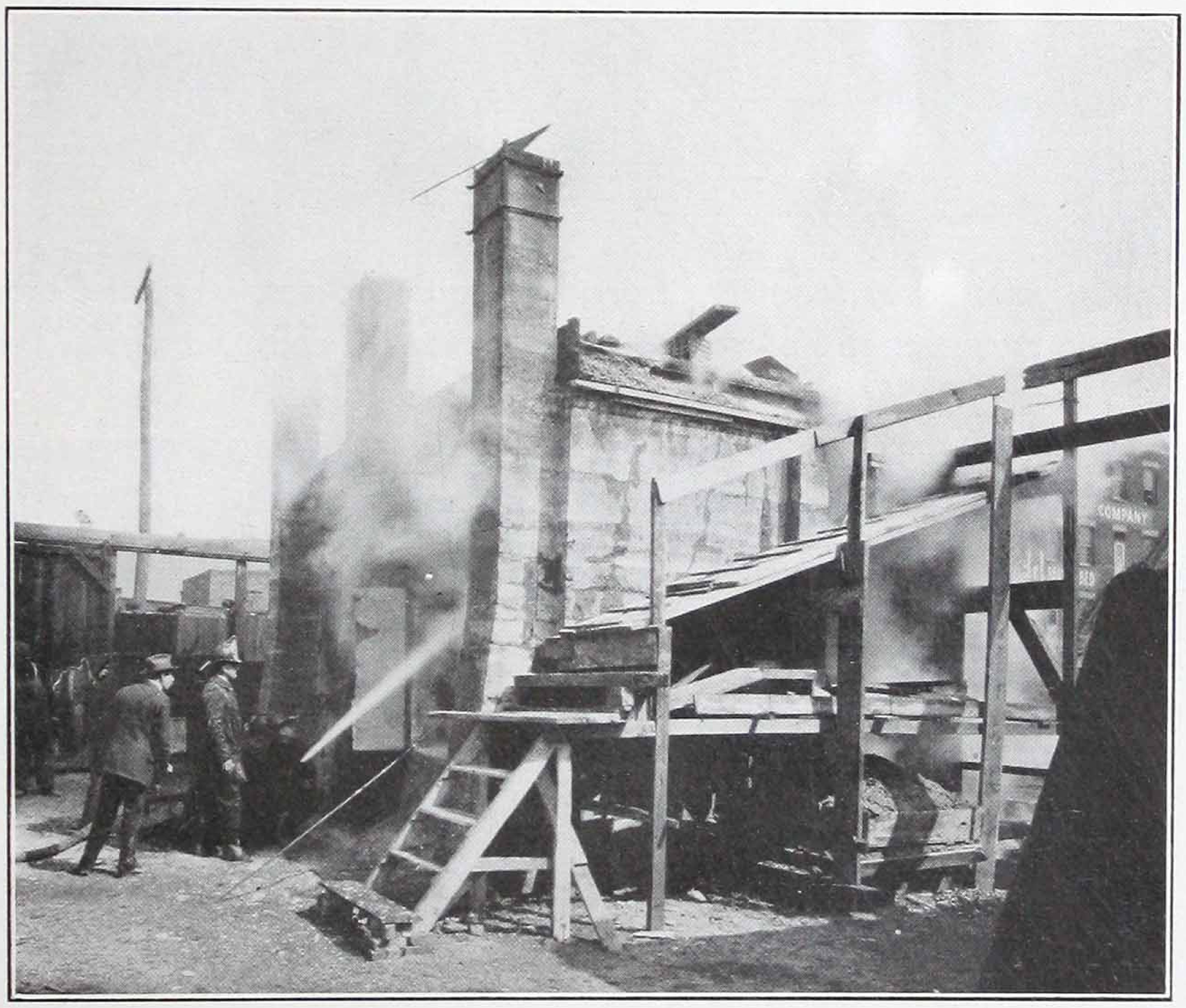
The maximum corrected deflection of the east beam was 55/64 inch, of the west beam 44/64 inch, and of the center of the slab 52/64 inch. The log of deflection readings will be found on page 26.

Effect of Application of Water

The application of water washed away the plaster coat to a depth of from $\frac{3}{8}$ inch to $\frac{1}{2}$ inch. Where cracks existed the plaster was furrowed out to varying depths; the general condition is clearly shown on page 26.

The metal lath was exposed in several places notably in the southwest corner where sagging took place, and along the crack extending parallel to and 5 feet from the front wall.

Several other very small areas were exposed. The bare lath after applying water formed about 2 per cent of the total area under test. Along the inner edge of the west beam the lath was exposed for a length of 5 feet to a width varying from 1 inch to $1\frac{1}{2}$ inches.



Applying the Water After the Fire Test.

Application of Load of 600 lbs. Per Sq. Ft.

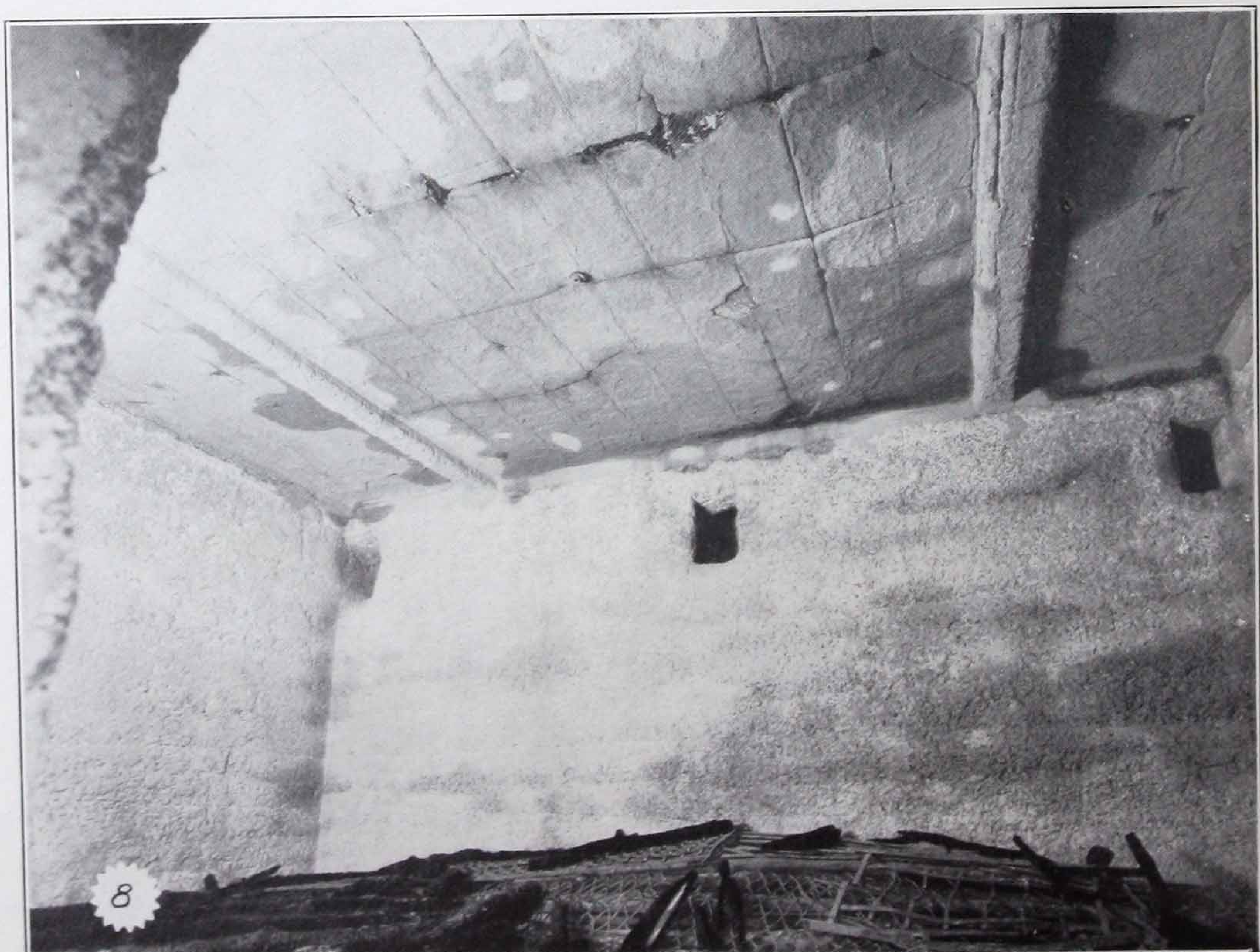
The application of the load of 600 pounds per square foot (see page 27), caused the beams and floor slabs to deflect as follows: West beam 1 19/64 inches, east beam 1 24/64 inches, middle of floor slab 1 49/64 inches. Upon removal of load the permanent deformation in the west beam was 42/64 inch, in the east beam 44/64 inch, and in the center of the floor slab 45/64 inch. The day following the loading test the cinder concrete slab was cleared away to expose and facilitate the examination of the beams, joists and other details. The ceiling between joists was sound enough to permit walking upon, and the joists showed but slight lateral deflection. See photograph on page 27.

No flame or water came through the floor and but a slight amount of smoke issued from one crack.

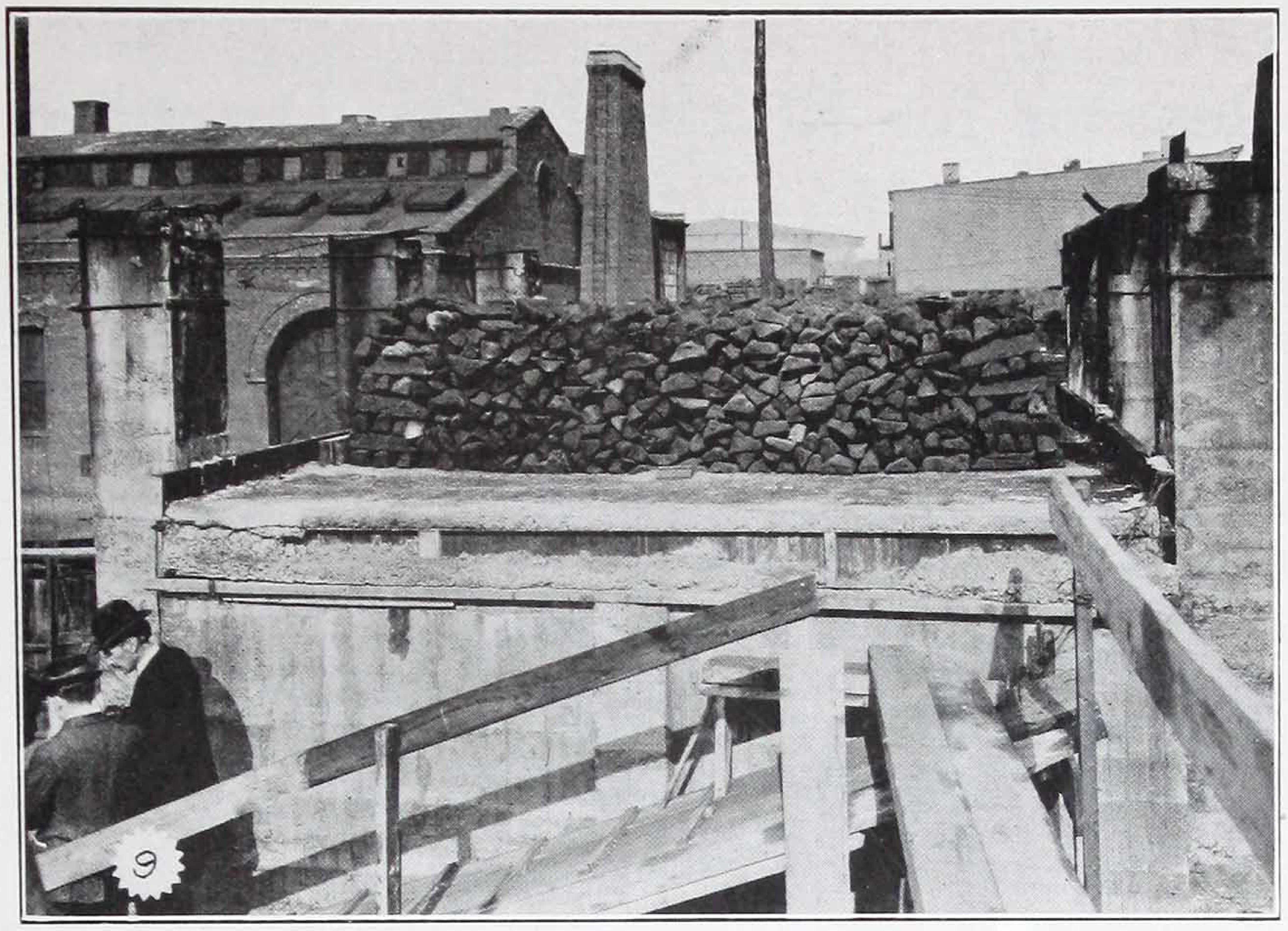
Corrected Total Deflection for Middle of Beams and Center Span, Taking Into Account the Rise of Ends of Beams.

TIME	ROD NUMBERS 2	4	6
April 13, 1915, 4:00 p. m.	4/64″	10/64″	3/64″
Load 150 lbs. per sq. ft.			
April 14, 1915.			
Start of Fire, 9:51 a. m.	4/64″	10/64″	3/64″
End of Fire, 1:51 p. m.	44/64″	52/64″	55/64″
After Water, 2:30 p. m.	1 22/64″	1 0/64″	1 39/64″
April 15, 1915.			
10:00 a. m., Load 150 lbs. per sq. ft.	1 9/64″	1 2/64″	56/64″
3:00 p. m., Load 600 lbs. per sq. ft.	1 19/64″	1 49/64″	1 24/64″
4:00 p. m., No Load	55/64″	39/64″	44/64″

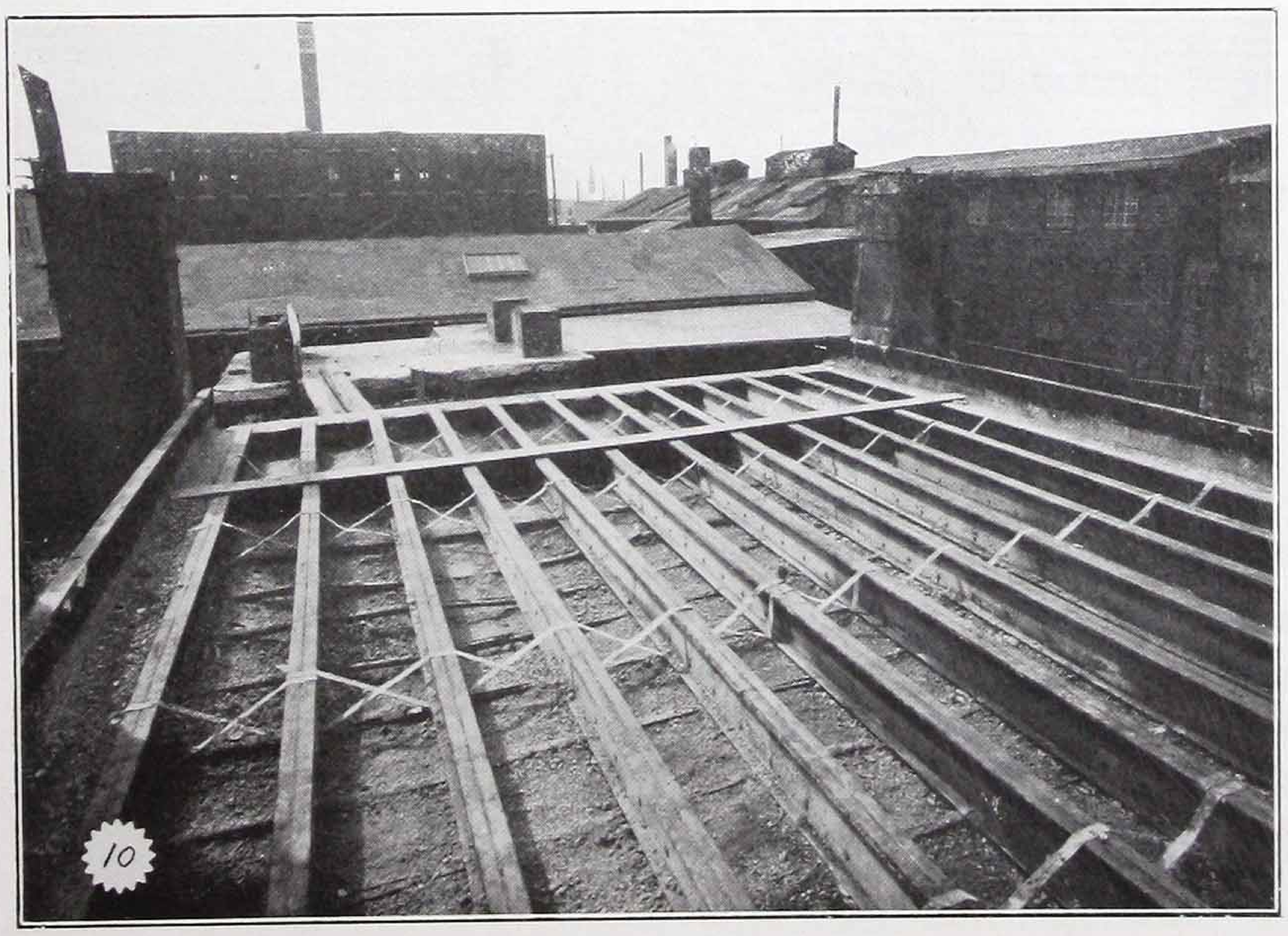
NOTE:—The results are obtained as follows: For all beam deflections, when the ends rise and the middle falls, add middle deflections to the mean of the two end rises. When the ends and middle fall, subtract.



Under Side of Floor After the Fire and Water Test.



Load of 600 lbs. per Square Foot Applied to Floor on the Day Following the Fire and Water Test.



View of the Floor System After the Fire, Load and Water Test, the Top Cinder Slab Having been Removed to Expose Joists and Other Details.

Reasons for Results Herein Described

There exists very good scientific reasons for the results obtained in the severe fire, load and water tests to which Berger's Metal Lumber Pressed Steel Floor Construction has been subjected.

Extensive tests show that internal temperature between the joists, the plaster and the concrete, does not exceed a certain degree when the temperature in the furnace underneath the joists and separated therefrom by 1 inch of plaster, averages 1700 degrees Fahrenheit for four hours. It naturally follows that the character of the Steel entering into the production of the joists must be capable of equal or greater resistance under the maximum temperatures than under normal conditions.

Twenty-nine years' experience in the manufacture of Pressed Steel Building Material, with unlimited facilities to control, as we do, the manufacture from the iron ore to the finished product, contrives to produce the quality of joists which the remarkable results of the tests herein described conclusively establish.

Ore mines, blast furnaces, open hearth furnaces, rolling mills and factories, operate with the point in view that the Steel entering into our Pressed Steel Sections is for a specific purpose.

The results shown by the tests can be obtained only by special analysis, heat-treated, cross-rolled and double-grained Steel.

Our Pressed Steel Sections are made from a special analysis Steel, designed to resist a high degree of temperature and still retain its tensile strength under full working loads. This point is conclusively established by reference to the tests.

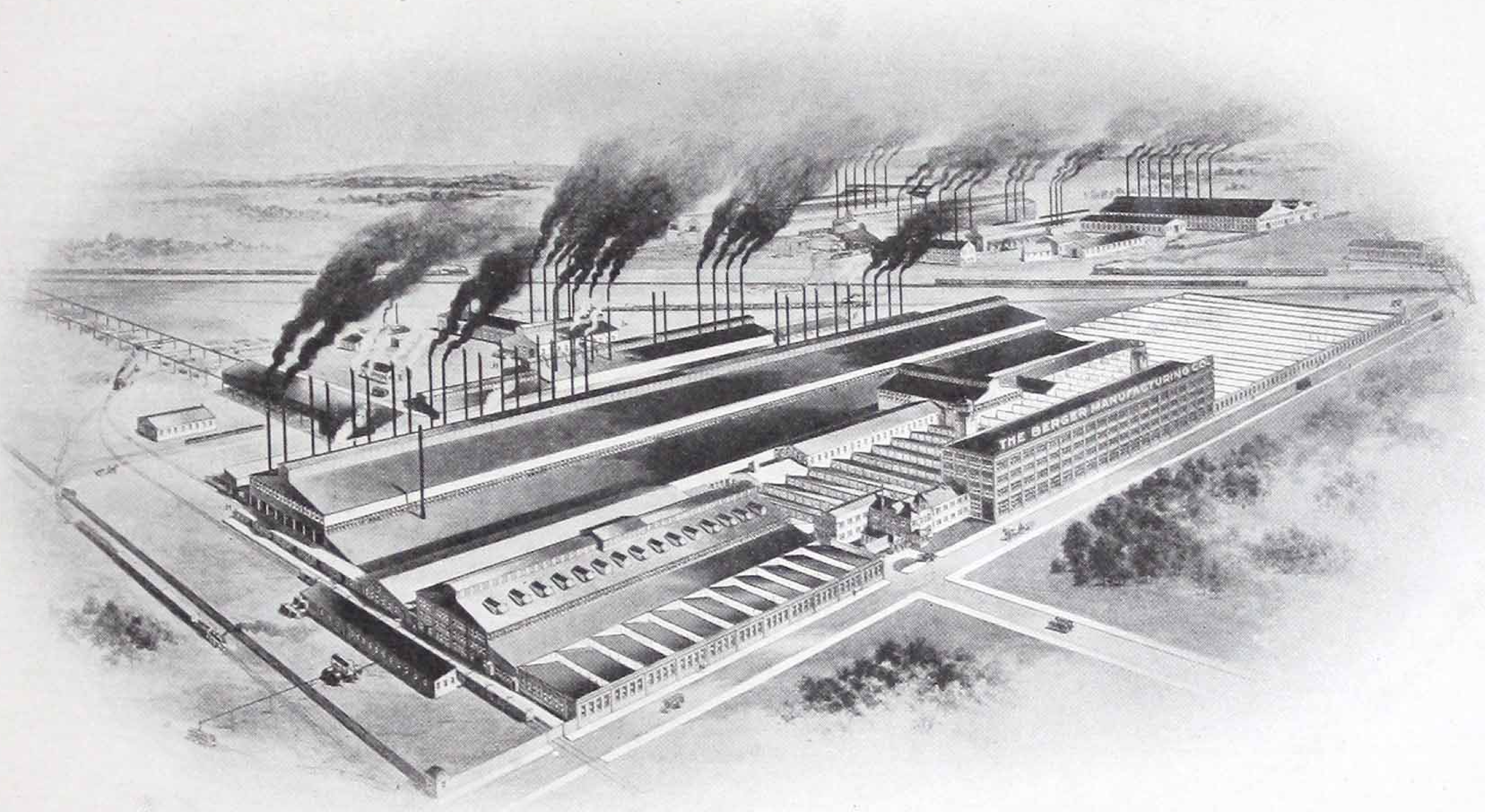
All Steel entering into the production of our Metal Lumber Pressed Steel Sections is carefully heat-treated and absolutely relieved of internal stresses. When these internal stresses, due to rolling and other causes, are not released by heat treatment, subsequent application of heat releases them and the result is buckling and warping.

The internal stresses in our Pressed Steel Sections are eliminated by the fact that all Steel used is cross-rolled and has a double grain. This result can be produced only by us because of the process we employ in manufacturing the Steel from the furnace through to the finished product.

The combined resources of the largest Pressed Steel manufacturers in the World, in connection with years of experience and experimental work, produce the product which has—

The proper quality of raw materials.
The proper analysis of Steel.
The proper rolling with a double grain.
The proper heat treatment.
The proper method of producing the section.
The proper form of section.
The proper relation of flanges to web.
The proper weight and dimension of section.
The proper spacing of joists in construction.
The proper bridging and location of same.
The proper paint for the product.
The proper method of installation.
The proper plaster.
The proper mixture and application of concrete.

H. M. NAUGLE,
Chief Engineer,
THE BERGER MFG. CO.



Plant and General Offices of The Berger Manufacturing Company, Canton, Ohio

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OFFICIALLY TESTED FIREPROOF

BERGER'S METAL LUMBER

PRESSED STEEL FLOOR CONSTRUCTION

Form 928 9-15 10m